ASTM BULLETIN

260 SOUTH BROAD STREET PHILADELPHIA, PA.

"Promotion of Knowledge of Materials of Engineering and Standardization of Specifications and Methods of Testing"

TELEPHONE—PENnypacker 3545 CABLE ADDRESS—TESTING

Number 90 January, 1938

Regional Meeting and Committee Week in Rochester

Symposium on Plastics to be Technical Feature; Committee Meetings Throughout the Week

As announced in the December Bulletin, the 1938 Regional Meeting of the Society is to be held at the Seneca Hotel in Rochester, N. Y., on March 9, and throughout the week beginning March 7 there will be in progress the annual Spring Group Meetings of Society committees. The technical feature of the Regional Meeting, the Symposium on Plastics, is being sponsored by Committee D-20, with a Symposium Committee headed by W. E. Emley, National Bureau of Standards. Other members include the chairmen of Committee D-20 subcommittees and a representative of the Rochester Committee which will be in general charge of arrangements for the meeting. I. C. Matthews, Eastman Kodak Co., is chairman of the committee comprising A.S.T.M. members in the Rochester district, and O. L. Angevine, Executive Secretary, Rochester Engineering Society is acting as secretary.

It is planned to hold the Plastics Symposium on the afternoon of Wednesday, March 9. In the evening, there will be a dinner arranged by the Rochester Committee with a special program. A well-known speaker is being obtained. The committee is also planning to have two motion picture performances, one on Tuesday evening, March 8, and the other on Thursday. The subjects will pertain to modern testing practices and manufacturing processes.

SYMPOSIUM ON PLASTICS

Reviewing such a publication as the second annual Handbook and Catalog number of *Modern Plastics,* issued in October, 1937, one cannot help but gain an insight into the remarkable progress which has been made in the production of plastics. Not only will he realize the tremendous strides made in the amount of material produced, but also the widespread and increasing use in many branches of industry, as well as in the ultimate consumer field, in which plastics are being utilized. While plastics have been produced in this country for many years, the most remarkable growth from the standpoint of production has been shown since about 1933.

The increasing importance of plastics and the necessity of developing standardized methods of determining their various chemical and physical properties led to the formation last year of a new Society committee designated D-20 on Plastics on which many of the leading companies and technologists concerned with this field are serving.

As one of its first important projects the committee will sponsor the Symposium on Plastics at the Rochester Regional Meeting. Six technical papers will form the basis of discussion as follows:

A Discussion of the Testing Methods for the Determination and Comparison of the Strength Properties of Organic Plastics—H. M. Richardson, Plastics Dept., Pittsfield Works, General Electric Co.

A Review of the Thermal Properties of Plastics and the Methods for Measuring Them—W. A. Zinzow, Chief Physicist, Bakelite Corp.

Flow Relations of Thermal Plastic Materials—C. H. Penning and L. W. Meyer, Tenite Sales and Plastics Research and Development Chemist, respectively, Tennessee Eastman Corp.

Permanence of Plastics—G. M. Kline, Chief, Organic Plastics Section, National Bureau of Standards.

The Properties of an Ideal Plastic—A. F. Randolph, E. I. du Pont de Nemours and Co., Inc.

Hardness as Applied in the Plastic Industry—J. C. Pitzer, Chemist, The Formica Insulation Co.

Each of the papers will deal with the particular field of work in which the respective subcommittees of Committee

It is planned to duplicate the papers in the symposium in advance of the meeting. Members who are interested in the papers and who wish to have copies in advance should write Society Headquarters indicating the ones they desire.

Contents

D-20 are essentially interested. It is expected that the information and data which will be correlated and presented and in addition the discussion that is expected to be given will be of widespread interest to many members of the Society. The committee in charge of the symposium plans that the papers will have a wide general appeal.

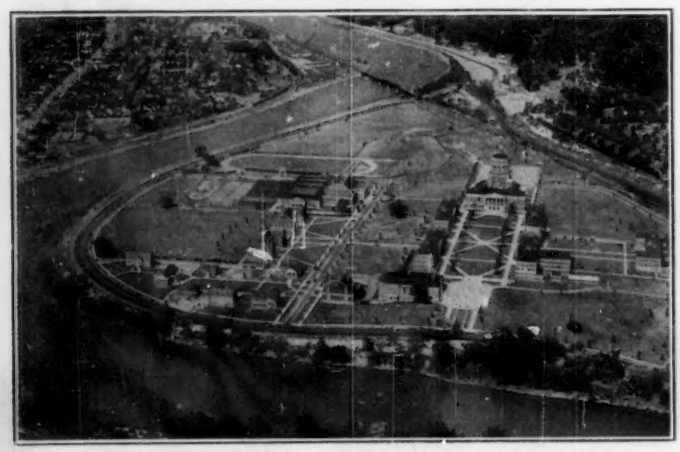
EXTENT OF THE INDUSTRY

As pointed out by T. W. Delahanty[1] "the plastics industry is in a state of flux and is constantly expanding its scope and increasing its magnitude. According to a preliminary report compiled from data collected in the recent Biennial Census of Manufactures, the total production of plastics and plastic products in 1935 (the last Census year) by establishments in the chemical industry is valued at $44,163,055, an increase of 82.6 per cent as compared with $24,188,191 reported for 1933. This does not include nitrocellulose articles made from purchased nitrocellulose plastics by establishments in a number of other industries. As a matter of fact, the domestic plastics industry is of so diversified a nature that adequate data showing production in all branches and distribution through all channels are not available. Indeed the industry is so decidedly not a static one that it is practically impossible to chronicle day to day progress. Trends of the day undoubtedly point to continued expansion in the plastics and molded products industries."

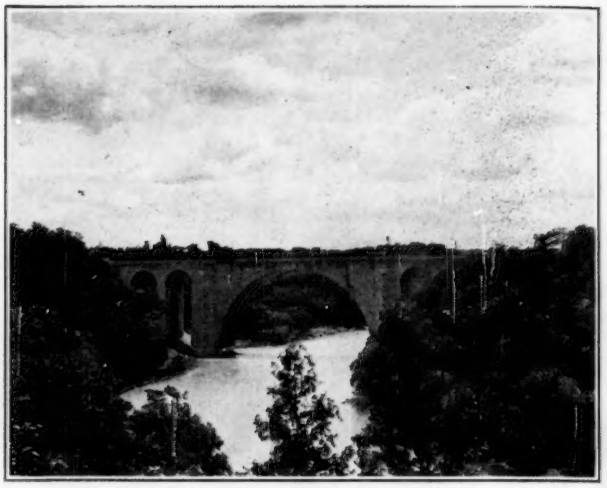
It is interesting to note that the production of synthetic resins, which together with plastics of cellulosic origin comprise the outstanding groups of plastics, increased more than three-fold in the period from 1933 to 1936, reaching an estimated figure of about 132,000,000 lb. During the same period the production of cellulose plastics products increased from about 14,000,000 to approximately 30,000,000 lb. This great increase in production of the material has also stimulated the production of plastic materials, fillers and other products which are used in the preparation of plastics.

The development of modern plastics has been described as one of the outstanding feats of modern science, much of it resulting from vigorous research activities that characterize the science of chemistry and its engineering applications.

[1] "Organic Plastics—Vital Industrial Raw Materials," *Modern Plastics*, Vol. 15, October, 1937, p. 5.



New University of Rochester Campus



Veterans' Memorial Bridge, Rochester

COMMITTEE WEEK

Quite a number of the standing committees of the Society will participate in Committee Week and hold meetings in Rochester. The procedure by which various main committees and their subgroups hold meetings during the five-day period has been successful and is definitely helpful in conserving the time and expense of a large number of members who are active in the work of different committees.

A committee schedule is developed to keep to a minimum the number of possible conflicts.

There follows a list of the committees which thus far have decided to meet in Rochester:

A-1 on Steel
A-2 on Wrought Iron
A-5 on Corrosion of Iron and Steel
A-7 on Malleable Iron Castings
A-10 on Iron-Chromium-Nickel and Related Alloys
B-3 on Corrosion of Non-Ferrous Metals and Alloys
B-5 on Copper and Copper Alloys
B-6 on Die-Cast Metals and Alloys
B-7 on Light Metals and Alloys
C-7 on Lime
D-1 on Paint, Varnish, Lacquer and Related Products
D-3 on Gaseous Fuels
D-4 on Road and Paving Materials
D-5 on Coal and Coke
D-6 on Paper and Paper Products
D-8 on Bituminous Waterproofing and Roofing Materials
D-11 on Rubber Products
D-18 on Soils for Engineering Purposes
D-20 on Plastics
Technical Committees of E-1
E-2 on Spectrographic Analysis
Research Committee on Fatigue of Metals
Joint Committee on Effect of Temperature on the Properties of Metals

A number of other committees are considering holding their meetings at Rochester and undoubtedly many of these will participate. Complete details will be furnished all members of the participating committees.

Last Call for Annual Meeting Papers

AT ITS meeting in Philadelphia late in February, Committee E-6 on Papers and Publications will give consideration to the papers which have been offered for presentation at the 1938 annual meeting to be held at Chalfonte-Haddon Hall, Atlantic City. A number of offers have already been received. All members and others who wish to present papers should send their offers to Society Headquarters not later than February 15—blanks to be used in transmitting the necessary information can be obtained from the Society office.

A summary must accompany each offer to make clear the paper's scope and point out features making it desirable for presentation.

1937 in Retrospect; Prospective 1938

Review of Society Activities for Past Year Indicates Much Progress; Important Work Under Way During 1938

WHILE this article which features each January BULLETIN has been termed a "review," it should more appropriately be termed not only a "review," but also a "preview," since much of the material presented discusses current work and other activities which are likely to develop rapidly during the coming year.

It should be pointed out that much of the information presented in the portion devoted to committee activities is in many cases taken directly from statements furnished each December by officers of the standing committees. The statements this year have been unusually interesting—indicative of the intense activity in various materials fields.

The committee material is segregated in accordance with the sequence of committee designations. The "A" group (ferrous metals) appears first followed by the "B" group (non-ferrous metals and alloys) and then the "C" committees (cementitious, ceramic, concrete and masonry) and finally the "D" committees covering a wide range of materials.

Viewed from many different angles, 1937 was one of the most active years the Society has experienced. Its standardization and research programs were carried on along all fronts intensively and a number of new projects were instituted, with three new standing committees formally organized. The year was notable in that the net increase in the number of members was greater than for any period in the last ten to twelve years. The Society publications were disseminated more widely than ever before, the income from sales reaching the highest figure ever.

All of the meetings held during the year were outstanding ones, each contributing measurably in advancing the work of the Society.

ANNUAL MEETING

The Annual Meeting, held in New York City for the first time since 1912, had the heaviest registration of members and visitors of any meeting yet held, totaling 1528. Another record established was the largest number of proposed standards accepted for publication as tentative, this figure reaching 51. During the meeting the Society's Fourth Exhibit of Testing Apparatus and Related Equipment was in progress, this being the largest and most interesting exhibit yet sponsored.

In the 19 technical sessions there were presented over 115 technical papers and reports, many of major significance. In addition there were several round-table discussions, one on precision and accuracy, another on impact testing and a well-attended one on the physical basis of the properties of metals. Important groups of papers included the Symposiums on Consistency, on Significance of Tests of Coal, and on Correlation Between Accelerated Laboratory Tests and Service Tests on Paints. There was a strong program of papers on asphalts and bituminous materials and in other fields. The Marburg Lecture by Dr. T. Smith Taylor on plastics was presented to the largest audience yet assembled at an A.S.T.M. meeting. The presidential address by Doctor Fieldner on "Fuels of Today and Tomorrow" created a great deal of interest and has received widespread attention.

One of the very interesting events of the meeting was the award of honorary memberships to three outstanding long-time members—Messrs. J. A. Capp, G. H. Clamer, and G. W. Thompson.

REGIONAL AND DISTRICT MEETINGS

The 1937 Regional Meeting held in Chicago in March was featured by two extensive technical symposiums, one on corrosion testing procedures, with seven papers, the other on lubricants with four comprehensive papers. This is the first time two formal symposiums have been held at a regional meeting. Each contributed important data and information on the subjects covered and the published symposiums have been very well received. During Committee Week, held the first week in March, there were about 600 committee members attending the some 150 meetings of main committees, sections, and subgroups.

Several local or district meetings were sponsored during the year by District Committees, each having an interesting program. In some cases the technical contributions have been subsequently published. Such meetings were held under the sponsorship of the Cleveland District Committee, January 28, with four papers on "Making of Specifications," and one under the auspices of the Pittsburgh District Committee, February 25, with three interesting papers on the subject of glass.

A Symposium on Wear of Metals featured the district meeting in Philadelphia in April, the six papers having been issued in a special publication. The district meeting in Detroit in April was devoted to "recent progress in rubber technology." The Southern California District Committee sponsored a meeting on June 19 with papers dealing with pH testing and the role of the laboratory in investigation and control of foundations and materials of construction.

NEW FIELDS OF WORK

With committees occupying such an essential place in the advancement of Society work, it is significant that three important new standing committees were formally organized during the year. These committees—on paper and paper products, on plastics, and on glass and glass products—have active programs mapped which should result in the near future in important Society contributions to these fields. In

addition to these new committees, several important subgroups of existing standing committees were organized to cover materials and subjects not previously covered.

The discussion of committee activities which appears later covers some of these important new fields.

PUBLICATIONS

The importance of publications in making readily available in convenient form the extensive data and information developed in the Society's standardization and research programs and in other ways is evident. The year was marked by the publication of a number of special volumes and the continued publication of special compilations of standards in specific fields. The distribution of these latter compilations has been extremely widespread and has undoubtedly resulted in a much more widespread use of A.S.T.M. standards. A new compilation was added to the list, containing all A.S.T.M. standards pertaining to cement.

STANDARDIZATION

The past year was very productive from the standpoint of new specification requirements and test methods standardized, and the list of new tentative standards is not only significant from the standpoint of number, but also from the angle of importance of new materials covered. Some 60 new tentative standards were issued for the first time during the year either as the result of action at the annual meeting or through Committee E-10 on Standards. The 1937 Book of Tentative Standards, in which these are compiled (the new ones are also in Part I, 1937 *Proceedings*) is the largest single book the Society has ever issued, containing 1630 pages and including 293 tentative standards. Adding to this figure the 19 methods of chemical analyses of metals which are tentative, the total is 312.

There were 44 standards adopted or revised, 18 of which are new standards, the remaining 26 being replacements of existing standards; total standards—511. A number of revisions in standards were also published as tentative.

One of the significant factors in viewing the standardization program as a whole has been the progress made by certain committees in combining two or three or more separate specifications or tests into a single document. This is truly an important phase of standardization work and while it is sometimes extremely difficult, several committees have been enabled due to intensive work and cooperation of the members to effect desirable combinations.

The continued policy of issuing special compilations of standards in specific fields such as petroleum products, rubber, electrical insulating materials, refractories, textiles, etc., is of particular significance when viewing the increased use of Society standards. A very definite trend in more widespread use of Society standards has been noted during the year. This is distinctly encouraging because only through general use can the value of the extensive standardization work of the committees be fully realized.

RESEARCH

A detailed review of the large number of research projects on which progress was made during the year appeared in the October BULLETIN. This has been supplemented by a reprint describing all of the 134 A.S.T.M. research projects. It is interesting to note that 15 new projects have been instituted, some of which are just getting under way. Two of these are concerned with the properties of cast iron and tin- and lead-base die casting alloys; the other 13 with test methods. Of the latter, four pertain to non-ferrous metals and alloys; two concern petroleum products, and there is a new project in each of the following fields: structural clay tile, fire tests, bituminous materials, coal and coke, liquid rubber products, bast fibers, and soils.

Some information on research projects is given in the descriptions of committee work which follows. A detailed study of the reprint (furnished on request) with all projects briefly described will give a more complete picture of the many fronts on which the Society is developing needed information and data.

Steel

Committee A-1 on Steel continued its active development of specification requirements for various types of steel and steel products. Nine new tentative specifications were developed, some of which give requirements for materials not heretofore covered. Of outstanding importance was the new standard covering iron and steel filler metal (arc-welding electrodes and gas-welding rods) developed in cooperation with the American Welding Society. Other new specifications cover seamless intermediate alloy-steel still tubes for refinery service and cold-drawn heat-exchanger and condenser tubes. Four of the specifications cover various types of alloy-steel plates for boiler and other pressure vessels involving carbon silicon steel, chrome-manganese-silicon (CMS), low-carbon-nickel steel, and molybdenum steel.

Because of the widespread use, particularly by the utility industry, of seamless carbon molybdenum alloy-steel pipe, this material was removed from the standard specifications covering seamless alloy-steel pipe for temperatures from 750 to 1100 F. and covered in a separate specification, the temperature range being limited to 1000 F. A number of important changes were made in the seamless alloy pipe specifications and also in the requirements for alloy-steel bolting materials for high-temperature service.

Yield Point:

The Research Committee on Yield Point of Structural Steel completed its extensive test program extending over several years and submitted a final report. The main efforts of the committee were devoted to investigation of the range in yield point when the material is furnished under specifications and the testing procedure which will insure sufficiently accurate determination of the yield point with a minimum of expense. Several series of tests were carried out involving many thousands of individual investigations.

In its report, the committee draws 14 conclusions based on various phases of the work and includes certain recommendations. One of these indicates that in the vicinity of the yield point the rate of pulling should be limited by rates of strain or by rates of stress. Tentatively for wedge grips and an 8-in. gage length the suggested maximum limit for the rate of strain in the vicinity of the yield point is 0.0015 in. per in. per min., corresponding to a stress limit of 45,000 lb. per sq. in. per min. The drop of beam or halt in motion of the pointer on the dial were indicated as sufficiently accurate methods in practically all cases. Locations were recommended for specimens cut from structural shapes. Finally the committee indicated that certain factors

should be investigated including fundamental reasons for age effects on all steels, the magnitude of age effects on the yield point and ductility of structural steels other than carbon steels.

Wrought Iron

A new tentative specification was prepared by Committee A-2 on Wrought Iron covering rolled wrought-iron shapes and bars (A 207). The increasing use of wrought iron in certain portions of highway bridges indicated the advisability of a specification for rolled sections which heretofore have not been covered.

Certain revisions have been published as tentative in the specifications covering iron and steel chain (A 56). There is one important proposed change—a revision of the proof test load figures to represent 38 per cent of the breaking load from the former ratio of 50 per cent.

All specifications covering wrought-iron products have now been revised to include a definite reference to the process of manufacture by the reinsertion of the word "puddling" in the manufacturing clause. This was omitted from all wrought iron specifications in 1930 simultaneously with an adoption of a definition for wrought iron. Exceptions to this general rule are specifications covering respectively refined iron bars and common iron bars (A 41 and A 85) which are not intended to cover a high quality material.

Cast Iron; Malleable Iron Castings

A complete revision of the Specifications for Chilled-Tread Cast-Iron Wheels is under way in Committee A-3 on Cast Iron. It is expected when completed the revised requirements will be in close agreement with A.A.R. specifications. An appropriation of $200 from the Society Research Fund has been granted to the committee to assist in research work on fatigue tests of cast iron being carried out by Professor Kommers, University of Wisconsin. Information developed in work on impact testing is to be made available to members interested in similar tests. A standard drop test machine must be adopted, however, and work on this phase is being developed.

Among the important projects before Committee A-7 on Malleable Iron Castings is a proposed specification for pearlitic malleable castings. It is expected a recommendation will be made to the Society during 1938. Another important activity involves work on the subject of welding malleable castings. A new subcommittee has been formed to develop this work; the study will also involve white cast iron to be subsequently malleableized.

Corrosion of Iron and Steel

The work of Committee A-5 on Corrosion of Iron and Steel involves two major activities—the preparation of specifications and test methods for materials and the carrying out of exposure tests. During the year two standards covering zinc-coated (galvanized) iron or steel farm-field and railroad right-of-way wire fencing and iron or steel barbed wire were revised in the form of new tentative standards. The major changes involve the inclusion of three weight-of-coating classes for fencing and barbed wire.

Specification requirements are being drafted to cover chain-link fence galvanized before weaving, methods for determining the thickness of plated coatings, and procedures for determining weight of coating on galvanized hardware. Revisions are being developed in several existing standards covering the following zinc-coated iron or steel materials:

(a) Chain-link fence fabric, galvanized after weaving.
(b) Wire strand (cable).
(c) Telephone and telegraph line wire.
(d) Sheets.

The committee expects to present a proposed specification for approval during 1938 covering the use of the Preece Test for determining the uniformity of coatings on hardware

The far-flung exposure tests being carried on by the committee have been continued with routine inspections being made during the year. These involve black and galvanized sheets and hardware and the immersion tests.

The committee has, this year, added a comprehensive series of outdoor tests on bare and galvanized wire, galvanized steel strand, farm fence, chain-link fence and barbed wire. The details of these tests, the samples exposed, their methods of mounting and locations have been published in the 1937 annual report. The referee testing of the physical and chemical properties of the materials as received from the manufacturers is being done at the National Bureau of Standards. This characterization of the test materials, including chemical composition of both base metal and coating and microstructure of the coating will require a full year's time of two associates and the job is approximately two-thirds completed at this time.

Of major importance in the successful prosecution of this latest of the series of outdoor exposure tests has been the formation and training of an inspection committee. Because of the wide separation of test stations, it will not be possible for the committee as a whole to inspect all stations regularly and the responsibility for the work at locations such as California and Texas will fall largely on the representative of the cooperating university assigned to this inspection work. For this reason, the inspection committee has held two practice inspections, one at Pittsburgh and one at Bridgeport, to determine proper inspection routines and methods for recording data in a standardized fashion. Following these preliminary inspections, a third meeting, announced in this BULLETIN, was held recently at Purdue. Experience gained in many years of field inspections of galvanized sheet and hardware specimens has enabled the inspection committee, under the chairmanship of Dr. C. D. Hocker, Bell Telephone Laboratories, Inc., to plan its work with considerable exactness. The Corrosion Committee anticipates with confidence the valuable performance data which will be derived from these tests.

Iron-Chromium-Nickel Alloys; Ferro-Alloys

The subgroup of Committee A-10 on Iron-Chromium, Iron-Chromium-Nickel and Related Alloys charged with the task of collecting and correlating data for publication has active work under way—the final form for charting the data has been agreed upon. The committee is continuing its program on the study of elastic properties of the 18 per cent chromium, 8 per cent nickel types of steel after various heat treatments. In the work on metallography a preliminary miscroscopic examination of samples of 18 per cent chromium, 8 per cent nickel steel after various heat treatments has been practically completed. Two heats containing 0.065 per cent and 0.098 per cent carbon are being examined and photomicrographs prepared at magnifications of 100 and 750 diameters. When this preliminary examination is completed,

work will continue to determine the nature of the grain boundary precipitation in austenitic steels of this type.

One of the interesting projects under way in the subcommittee on methods of corrosion testing is the inspection of existing installations of materials in the province of the committee and correlation of service with previous manufacturing history. A section of the committee has recently inspected installations of stainless steel at the Chrysler Building and Empire State Building in New York City and an interesting report has been prepared based on results of the studies. At the Chrysler Building none of the stainless material, according to the committee's report, on the spire or copings has been cleaned since erection. The metal is in excellent condition, although covered with "traffic and smoke film." The store fronts on the ground floor are cleaned every two months and demonstrate stainless steel at its best.

At the Empire State Building, vertical strips of stainless steel running from the sixth floor to the observation tower have not been cleaned since completion of the building. There is no pitting and a condition reported as red rust turned out to be a leaching of the caulking compound from the overlapped joints.

Other activities of the subcommittee include the preparation of recommended procedures for corrosion testing and compilation of information on the subject in an effort to standardize or rationalize such procedures.

There has also been suggested a proposed study of the effect of atmospheric corrosion through the medium of test specimens of various alloys with various methods of preparation. Consideration is being given to this project.

Committee A-9 on Ferro-Alloys is conducting a study of ferro-alloy specification requirements which have been issued with the object of bringing them up to date where necessary. Consideration is being given to the development of standards for ferroboron and ferrotitanium.

Another activity involves a survey of consumers of various types of ferro-alloys to ascertain the extent of use of A.S.T.M. specifications; an attempt will be made concurrent with this to develop suggestions for improvement of the requirements. It is anticipated that the survey may show a need for certain new specifications.

Magnetic Properties

In order to limit the eddy current losses in laminated magnetic cores subjected to a.c. magnetization, it is necessary to electrically insulate the laminations from each other. For small cross-sections and light pressures, the natural scale is often sufficient, but generally, some kind of coreplate enamel is applied to the surface of the sheets. Manufacturers and users of electrical sheet use a variety of samples and test methods for determining the resistance between sheets.

In the interest of uniformity, the subcommittee on alternating current test methods of Committee A-6 on Magnetic Properties has prepared proposed specifications covering inter-lamination resistance which are to be submitted to the main committee for approval and referred to the Society.

There is also in preparation a specification for stacking factor (space factor). A definite pressure is applied to a pile of laminations and from the height of the stack and an assumed specific gravity, the per cent solid material is calculated. This gives an indication of the smoothness of the surface of the sheets and the amount of space occupied by the scale and enamel.

Effect of Temperature on Metals

The program of sponsored researches being carried on by the Joint A.S.M.E. - A.S.T.M. Research Committee on Effect of Temperature on the Properties of Metals has been enlarged appreciably. In order to permit a more equitable distribution of responsibility and work among the membership, reorganization of the committee set-up was effected during the year. Special committees are appointed to handle a project and upon completion of it, the committee will be automatically discharged.

Included in the research projects being carried on is work to permit comparisons of creep under biaxial stresses (tube tests) and under unidirectional stress (usual tension creep tests). The biaxial stresses will be obtained by internal pressure in tubes in special testing equipment. Materials involved are carbon-molybdenum steel and 5 per cent chromium steel containing molybdenum. An extensive compilation of available creep test data is being compiled in order to secure for engineers a better idea of the creep characteristics of the commonly used metals. In the project concerned with the validity of tests of several hundred and several thousand hours' duration as indicators of creep "strength" for practical service life of 20,000 hr. or more, one of the carbon steel bars (K20) is still under test, the load and temperature having been maintained continuously for more than 17,000 hours. Another project covers torsion-creep tests, it being hoped that the data resulting, when compared with tension-creep tests may throw further light upon plastic flow phenomena.

Metallography

In the field of metallography current work being carried out by the Society's Committee E-4 concerns the preparation of a technical report on plastic mounting materials for metallographic specimens. As indicated in a short article in another portion of this BULLETIN, the committee has found a source of polishing cloth suitable for metallographic work. A report on the use of polarized light in metallography is to be developed with the aim in view of eventually establishing some standard practices. In order to recommend practices in the field of dilatometric analysis which could be recommended for general use, there is being prepared a report covering methods and apparatus now in use. A study of grain size specifications in steel is being continued for the purpose of developing requirements to meet some of the objections raised to the present standard grain size chart (E 19). A proposed new chart has been circulated and is expected to come up for action at a future meeting of the committee.

Chemical Analysis of Metals

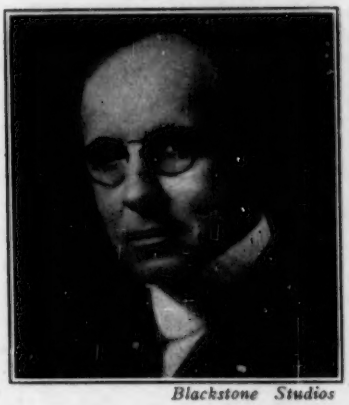
In order to meet the demand, there has been required a second printing of the volume, "A.S.T.M. Methods of Chemical Analyses of Metals," which gives all the analytical procedures for ferrous and non-ferrous metals and spectrochemical analyses methods. The methods of chemical analyses are in the charge of Committee E-3. This committee is continuing its study on procedures for the determination of aluminum and columbium in steels and is preparing methods of analysis of copper, lead, aluminum and their alloys. Revisions have been developed in the methods of chemical

(Continued on page 31)

Some Fundamentals in Standardization— Thirty Years in Retrospect[1]

By Frank B. Jewett[2]

EDITOR'S NOTE.—In connection with this paper, it is of interest to note that Doctor Jewett has been chosen as the recipient of the Washington Award for 1938. He is a Past President of the A.I.E.E., President and Trustee of the New York Museum of Science and Industry, a Term Member of the Massachusetts Institute of Technology Corp., and a member of many other educational and scientific societies and institutions. Prior to his association with the communications field he was Research Assistant to Prof. A. A. Michelson, Department of Physics, University of Chicago, and Instructor in Physics and Electrical Engineering at M.I.T. In 1928 he presented the Edgar Marburg Lecture before our Society on the subject "Some Research Problems in Transoceanic Telephony."



Dr. Frank B. Jewett

Blackstone Studios

IN PRESUMING to speak to this group, concerned as you are with the details and intricacies of standardization, I cannot escape feeling somewhat like an embarrassed Rip Van Winkle. Although I have been interested in and more or less concerned with standardization in applied science for over thirty years, it has been a long time since I have had any active part in attempting to formulate standards. Actually I have not had time even to keep myself up to date on the details of your standardizing machinery.

As a matter of fact, my last participation in standardization work had nothing whatever to do with standardization *per se*. It was concerned rather with some of the problems involved in the creation of this body and the formulation of procedural machinery capable of producing the things we designated as standards. In view of all this, you will probably not wish to take some of my observations too seriously.

During these thirty years our concept of standards has changed greatly. Initially we were concerned mainly with rather simple engineering standards—blood relation to the standards of the fundamental scientist. Gradually we have seen them evolve where necessary to incorporate elements primarily important to the operator and user or consumer. The circle of those around the council table has enlarged as has the field in which progress by standardization is essayed. Each major enlargement has almost invariably been accompanied by some element of conflict of opinion. The established standardizing group (or some of them) are, and for the most part wisely, hard to convert to radically new ideas projected from the outside and from peculiar angles.

CHANGES FAR-REACHING

In the early days engineers were forced into attempts at standardization in order that they might discuss intelligently matters of common interest; and to compare results. These matters were of little interest to others at the time. For the most part the work of their committees and associations was of scant concern to the community which was coming more and more to use and depend on the products of engineering craftsmanship. In this respect, more possibly than in any other, the changes wrought by three decades of evolution have been far-reaching not only on the operations of society but likewise on the methods and objectives of standardization itself.

This Association, which is the direct lineal descendant of the first engineering society standards committees, has come gradually into a position of great power and grave responsibility—greater and graver even than most of us appreciate, I suspect. Not only does your approval influence directly the things of industry with which you are concerned and the affairs of their users, but in many directions it becomes part of the base of statutory regulations, ordinances, or laws. It is from this angle that much of your enhanced responsibility for careful, thoughtful, and meticulous functioning arises.

The formal ordinances or laws of the State are hardy "beasties," difficult to change and almost impossible of extermination. They spawn argument, conflict, and litigation at a prodigious rate and of a kind that gladdens the heart of those who like to fish in muddy water. Since much of the water is now of your making, it behooves us to look well to its quality and filtration before turning it into the public distribution system.

Outside what I have observed of standardization in other fields of applied science, substantially all my ideas concerning it, concerning its possibilities and limitations, concerning the objectives for which it is undertaken, and particularly concerning the basic rules which, it seems to me, should govern approach to the formulation of any standard, have been derived from the experience of nearly thirty-five years devoted to the orderly development of electrical communication. Throughout this entire period, standards and standardization have been looked upon as powerful tools for progress in the communication art. Occasionally, but not often in recent years, they have turned out to be serious obstacles to it.

Having determined many years ago to make the development of telephony and its collateral forms of electrical communication in the Bell System as far as possible an orderly process based on established principles of science and engineering, it was inevitable that standards and standardization should early come in for careful analysis.

Because of the peculiarly favorable conditions for unity of operation present in the structural set-up of the Bell System—research, development, manufacturing, installation,

[1] Presented at the 1937 Annual Meeting, American Standards Association, New York City, Dec. 1, 1937; reprinted from *Industrial Standardization*, December, 1937.

[2] Vice-President, American Telephone and Telegraph Co.; President, Bell Telephone Labs., Inc.

and operation all under a common direction and with all parts of the organization concerned with a common objective—our experience might be considered in the nature of a trial installation of standardization under ideally controlled conditions.

. While all of us have subscribed to the common objective of the best and most extensive service which science and art can provide at the lowest cost consistent with financial safety, I would not have you think we have been free from violent differences of opinions in the matter of standards to be adopted or altered. In so far as matters relating to standards were wholly of internal concern, the one thing we have been spared was the conflict of divergent views based on real or assumed differences of objective.

Since the only thing we sell to the public is service, we have in the main been free also from the ordinary manufacturer-customer conflict of requirements in our standardization of the material things required for giving that service. To a considerable extent it is immaterial to us which of two things we decided to standardize, provided only that the one chosen when related to all the other factors which make up final overall cost will give the best life service at the lowest cost. Thus, as between two designs giving equally good operational results, we have no hesitancy in standardizing the one of higher initial cost if it is clear that by so doing we will save much more than the difference by reduced maintenance expense over its useful life.

EARLY CONCLUSIONS STRENGTHENED

My first study of standardization and the function and place of standards led me to certain conclusions, most of which have been strengthened by subsequent experience.

In the first place, it seemed clear that when the art had progressed far enough in any sector to make true standardization feasible, the establishment of standards and rigid adherence to them until they were superseded by better standards was the only certain way to ensure orderly and expeditious progress.

In the second place, it seemed clear that the standards set should take account of *all* the pertinent factors and should so far as possible omit *all* non-essential requirements; in a word, that they should make mandatory only those things clearly necessary in the attainment of a desired result and should leave maximum freedom for variation in all else.

In the third place, it appeared that standards should never be allowed to take on the habiliments of things sacrosanct but should be under continuous critical surveillance; that they should be discarded or modified promptly whenever it was clear that they had ceased to be tools of progress and become hindrances to it instead.

STANDARDS SHORT-LIVED

As a result of these and numerous other fundamental considerations which will occur to all of you, standards as we employ them in the Bell System are frequently short-lived affairs. We respect and value them for the help they give us while they live. We refuse to let them dominate our thinking and we discard them without a qualm when they become shackles. I think our attitude toward them might be expressed by saying that in our picture today's standards are today's statement of the most we know about the things we employ. Tomorrow's standards may or may not be the same. One thing we do when discarding an old friend is to be sure that the new one will serve us better, and, so far as possible, to have a definite bridge between the old and the new.

> ***. . . establishment of standards and rigid adherence to them until . . . superseded by better standards {is} the only certain way to ensure orderly and expeditious progress.***

Another thing we learned early in our work was that a nice question was involved in determining just when to attempt standardization. If it was attempted too early in the development of a new thing or a new method we ran not only risk of wholesale use of something inferior to the best attainable, but to a considerable extent we shackled and strait-jacketed development. If standardization was too long deferred, development and use tended to run riot and produce a situation akin to one in which there were no standards or guide-posts to serve as definite points of departure.

On the whole I am inclined to think that the first, *i.e.*, a too early standardization, involves the greater hazard. It is a serious thing to stimulate the use of an inferior thing or method by designating it as a standard. It is a far more serious thing to shackle and delay development by so doing.

The establishment and promulgation of engineering or industrial standards always have a powerful influence on men's thinking and acting. There is universally a tendency to think and work *toward* a standard—seldom away from it, unless those concerned with the thing standardized appreciate fully that the standard is simply a transitory affair. Men will invariably spend more energy and thought in the direction of achieving the standard than they will on breaking new ground beyond it. They have a tendency to exercise their energy and inventiveness largely in devising cheaper ways than formerly of attaining standard results.

Where the established standard is distinctly above the average of the things to which it applies, this magnet-like tendency has it advantages because it stimulates those who are in the inferior position to seek a higher level, and, because they are in such case a majority, it acts to raise the general level even when it retards somewhat those who have been most progressive.

With premature standardization also all the forces involved are marshalled largely behind the status quo. Custom, established methods, money invested in tools or plant —all argue against change. It is so upsetting!! On the other hand, where proper standardization has been delayed beyond the time when it should have been done, the very turmoil and chaos of the resulting situation almost automatically impells conflicting interests to seek a common meeting ground. Further, from the welter of confused experience there is much material that can be salvaged in the making of a standard.

NEED TRIAL PERIOD

Although I realize the difficulties inherent in the process, it has always seemed to me that the tool of "trial installation" could in many cases be a valuable addition to the machinery

. . . standards should never be allowed to take on the habiliments of things sacrosanct but should be under continuous critical surveillance;

of standardization. Possibly in my ignorance of modern standard-making methods, I am advocating something which is already in effect. All that I have in mind is a field trial of the thing proposed on a sufficiently large scale and under sufficiently complete observational control to test thoroughly all the factors involved without committing everybody in advance to the new proposal. In a way the "tentative standard," or whatever you designate it, is along the lines I have in mind, although as I have observed its operation in some cases it seems to fall short of what I have in mind. It invites and depends too much on uncontrolled and uncoordinated observation and so retards final decision and leaves that decision largely involved in a compromise of opinions.

In the Bell System where, as stated earlier, research and development, manufacturing, engineering, installation, and use are all looked upon merely as parts of a common problem, and where standardization is undertaken solely to insure the best that the current art affords and to facilitate improvement in the elements involved in rendering service, the controlled field trial has long been an established routine. No new thing of any importance is ever put into general use without it.

"INDUSTRIAL GUINEA PIGS"

Primarily designed to bring to light defects or improvements which have either been overlooked in the laboratory or which from their nature can only be determined in the field, the field trial serves almost automatically to determine the requirements of new standards which can and should be established for use, until they in turn are supplanted by still better ones. It is, in fact, use of industrial guinea pigs. While it does frequently involve experimentation on the ultimate consumer, it is only on a limited group of consumers, so that adverse reactions can never reach major proportions.

When it comes to how standards should be made and who should participate in their formulation, it has always seemed to me that machinery like that of the American Standards Association, or some body similar to it, is the only sensible kind to employ, except possibly in those fields involving matters of such vital importance to the general population that only political Government has the power to cope with them.

Even here, however, it is hard to see how an organization such as the American Standards Association can fail to be of the utmost assistance. The technical and scientific world has become so complex, and controlling factors in almost every sector are found in such unexpected places, that only by having a forum where every one who has a right to be heard can be heard, are we assured of that final judgment which will command adherence and respect.

COMPROMISE NECESSARY

Furthermore, it is only from such a voluntary association that we can expect to have that degree of compromise without which no industrial standard, however perfect and desirable it may appear to its makers, can hope to succeed. I have observed that it is the exception rather than the rule when men are reasonably unanimous in acting like rational human beings. Ordinarily, we are a perverse lot who greatly dislike being told what we must or must not do even when we know that the prescription is clearly in our interest. If, however, we feel we have had our day in court we are usually ready to give the verdict a fair trial, including a peaceful appeal, if necessary, to the court if we are still dissatisfied, before we resort to arson and mayhem.

It is when we feel that our interests have been grossly outraged or our evidence slighted and passed over in the final decision that we put on our guerrilla togs and go out on a foray. All of this is just as true in the field of standardization as it is in any other area of human activity. Any standard which is made and promulgated in opposition to the fixed opinions, however acquired, of any considerable group involved in its operation, is foredoomed to hard sledding and almost certainly to failure. Such a group would be more than human if they did not seek to make it fail.

It was considerations such as these which long ago led me to feel that to be successful in the field of standardization, the body responsible for a work which has become increasingly important to industry and commerce and to society generally, should have certain characteristics. It should be a voluntary association with the broadest possible constituency in the field of its interest; its operations should be democratic, with all that that implies of much essentially futile discussion and apparent procrastination; it should let facts, so far as they can be obtained, rather than opinions, determine the answer; finally, the Association itself should not be clothed with any police powers of enforcing its own findings—it should depend on the proven validity of its conclusions and the recognized standing of its members if it would insure general acceptance of its work.

IMPORTANCE OF FACTS

Apropos of these two last points, I should like to remark that they but paraphrase observations made to me many years ago by two wise men, now dead, who were my friends —General J. J. Carty and Mr. Elihu Root. Early in my career as one of his assistants, General Carty impressed on me the importance of getting facts before forming opinions or drawing conclusions if one wished to obtain a valid and acceptable answer. It was his belief, and one he operated on consistently, that the answer to almost any question is 90 per cent automatically self-evident if one takes the trouble to assemble and scrutinize the known or ascertainable facts which bear on it. Anyone who was ever involved with him in consideration of some knotty problem will never forget the interminable hours, days, and even weeks or months which he devoted to fact-finding. It was soul and patience-trying and it led into most unexpected places and to most unexpected individuals but it got results that were rarely wrong.

. . . only by having a forum where every one who has a right to be heard can be heard, are we assured of that final judgment which will command adherence and respect.

Long ago Mr. Root pointed out to me the inherent fragility of action based primarily on legal authority and the almost irresistible power which inhered in the judgment of a body of men possessed of no power to enforce that judgment but who were recognized to be men of ability and character and who formed their opinions with studied deliberation.

My distrusts of Government as a maker of standards that affect commerce and industry, *i.e.*, outside those sectors of public health or safety or national defense where Government alone can act, are more basic than fear of intrusion of political factors. They reside (1) in the belief that the agencies of Government, circumscribed as they are of necessity by the restraits of Government, are not in the best position to obtain and appraise all the facts; and (2) that being agencies of Government anything they emit tends to appear more important than it really is and more difficult to abandon or modify.

GOVERNMENT SHOULD PARTICIPATE

In other words, standards made by Government are, it seems to me, more likely to become instruments of restraint to progress than are those emanating from a mobile body like the American Standards Association. When to this is added the almost inevitable tendency that develops in men clothed with apparent authority to exercise it punitively, it seems to me that the case for the voluntary association in the field of standardization is substantially iron-clad.

Nothing of what I have just said should be construed as a belief on my part that Government should be excluded from participating in the making of standards—quite the contrary. Government should participate largely but, I think, on the same voluntary basis as the other members of the Association. Added to its general concern in establishing standards wherever these are clearly in the public interest, Government in times of peace is itself a large consumer and so entitled to be heard. In times of war it is the largest consumer. Anything in the direction of wise standard making in times of peace which will facilitate the functioning of Government and industry in time of war is obviously in the common interest.

I know that all the foregoing is "old stuff" to you and I am not saying it with any thought that it need be said here where all agencies—Governmental and non-Governmental—meet together. What I really had in mind in saying what I have is that possibly my opinion based on long experience may add a pebble to the dyke which periodically has to be raised against a demand that Uncle Sam take on part or all of this standardizing job because he can do it so much better or so much faster. It is usually a plausible tale that is told and it has only one demerit—it is not true.

In concluding I do not know that I can do better than attempt in brief summary to restate my own picture of what proper industrial standards should be, how and by whom they can best be formulated, and some of the things which appear to me we should guard against in their use.

"INDUSTRIAL," "ABSOLUTE" STANDARDS DIFFER

Before doing this I should like, however, to emphasize two things which, while interrelated, are frequently badly confused particularly by the non-technical public. First, industrial standards are essentially different from the so-called "absolute" standards of science—such, for example, as the unit of time. The "absolute" standards if accurately determined and readily reproducible are "absolute" in a very real sense—they are ordinarily not subject to change with advancing knowledge. They are the scales by which we measure it.

Industrial standards on the other hand are akin to the hypotheses of the scientist. They define our present state of knowledge and they live only so long as they continue to define adequately. As soon as they fail so to define, they are for all practical purposes as dead as the ancient Dodo or the Great Auk and like them are of interest only in a museum.

To the non-technical this difference is not generally understood and from the misunderstanding arises much difficulty. To them "standard" has come to denote something fixed, final, and generally desirable. They instinctively resent anything which seems to cast doubt on its paternity and they impute base motives to all who advocate change despite the fact that changing industrial standards are the very hallmark of industrial progress.

Now for my summary picture.

TOOLS FOR PROGRESS

To me a proper engineering or industrial standard is a temporary statement which includes all that is really essential of proven current knowledge to define the thing standardized. It is a specification which can be met in current commercial practice and a tool by which the art can progress. It carefully excludes everything which is non-essential in order to insure maximum latitude alike to the developer and user. In a word, it is a common meeting place for purchaser and seller with no signs of *caveat emptor* about.

It is continually under scrutiny by all who have occasion to use it and is subject to ruthless modification or abandonment as soon as it has clearly ceased to function as intended.

It is created by a voluntary association of all groups who have a definite interest in its existence and by representatives of them chosen because of established reputation for competence and ability to weigh evidence, honestly and impartially. The standardizing body itself should be without legal power to enforce its conclusions but like the Supreme Court should depend on the recognized merit of its findings. Where reasonable doubt exists as to the necessity for standards, the Association should err on the side of too few rather than too many.

Where it is known or believed that the standard sought to be established is likely to become adopted into ordinances or laws and so subject to administration by men who have legal authority of enforcement, the obligation on the Association to be meticulous in its final decision is greatly enhanced. Merely to clothe a standard with the habiliments of ordinance or law is to lessen materially our ability to change promptly in the face of changing conditions. With increasing prestige of the American Standards Association there will inevitably be increasing tendency for our gentlemen and lady "fixits" to enact laws based on its authority. Like "De Lawd" in "Green Pastures," we are great on passing miracles in the form of laws. The only thing that saves us from our sins in this respect is that we don't take the matter too seriously—not even seriously enough to want to stop the practice.

Tests for the Physical Properties of Textile Fabrics[1, 2]

By Ethel L. Phelps[3]

THE most commonly measured physical properties of fabrics include the dimensions of the material, that is, length, width, and thickness; its weight; the construction of the fabric, such as count and crimp; the load-elongation relations, such as breaking strength, elongation, tearing strength, and bursting strength; shrinkage; slippage; and color fastness. For each of these test methods one might ask, what is its present status? What factors require special attention in connection with its use? What is it applicability? In this present discussion, however, only certain general subjects are treated, such as sampling, the equipment and procedures used or recommended for use, and the interpretation of data.

SAMPLING

In looking over the number of samples or replicates to be taken for these various tests one is tempted to inquire whether five may not be considered a sort of "magic number" for textile testing. It is specified as the number, or minimum number, of replicates for about half of the tests mentioned above as outlined in the Society's General Methods of Testing Woven Textile Fabrics (D 39 – 36)[4] and also is found in other A.S.T.M. standard or tentative methods for textiles as well as in the Federal Specification CCC - T - 191 and in the Commercial Standard CS 59. This same number of replicates is specified to give what should be a representative picture of the fabric for such properties as width or count on the one hand, and thickness or strength on the other hand, whereas the variability in the second group is likely to be much greater than in the first. In addition, those cases where "five or more" are mentioned include only width, count, and thickness.

Again, one may observe what appear to be inconsistencies in the number of samples to be used when comparing some of these tests in the several standard and tentative methods. Nowhere in the directions for sampling is there found recognition of greater uniformity in some fabrics than in others, and nowhere is there a statement that a sufficient number of samples should be taken so that the precision of the sampling may be related to the magnitude of the property being measured. Might this precision be expressed as one pound, or one yarn, or 0.001 in. as the case may be, or of one or two per cent of the approximate value, if it were desired?

The emphasis on location of the samples is also variable as regards the strip adjacent to the selvage which is to be excluded; the length of the end of the piece to be excluded; and the precise location of the test samples within these restrictions. It might also be asked to what extent has the cost of the material or the convenience of the technician determined custom in sampling for testing purposes? Or, given a one, two, or three yard length of cloth, could not all samples be taken uniformly over this area? And has the representativeness of the sampling been commensurate with the precision of the method for which the sample is to be used?

EQUIPMENT AND PROCEDURES

Methods for the determination of *width* in most cases do not specify that the measurement is to be made perpendicular to the selvage. In this connection what is the width of a fabric? Is it the distance between the outer edges of the fabric and perpendicular to the selvage, or is it the length of the filling yarns as they lie in the cloth without external tension? The measurement of *thickness* commonly is made under some stated load, but no mention has been found of any possible variation of the load to be used in relation to the unit weight of the fabric being measured.

The determination of the *weight* of a fabric involves both measurement and weighing from which the weight per linear or square yard is calculated. The whole bolt or a large sample are to be weighed in some cases. Recently a student using an analytical balance and triplicate samples of sheeting varying from 2 by 2.5 to 20 by 20 in. found no appreciable difference in the calculated weight per square yard. This would seem to indicate that the values from a small sample need not be less reliable than those from a larger one. Possibly a small sample can be cut with greater accuracy than a full width sample can be measured. At any rate the sample should be cut and measured with precision, using an accurate instrument. In addition, the weighing should be made on a scale which also is accurate and suitable in capacity.

The *count* or number of yarns per inch in a fabric is made with a so-called "thread" counter, preferably over a light box. Haven[5] recommends counting to the nearest full yarn and mentions the necessity of cutting and raveling a sample in cases where the yarns cannot be distinguished by the usual method. Again, as in other measurements, the fabric should not be held under tension while this determination is being made. The scale of the counter should be placed exactly perpendicular to the set of yarns being examined. The number of ends or picks in not less than 1 or 3 in., as specified, should be included, according to the method.

In the determination of *crimp* an exact length measurement again is essential. In addition, the correct tension to be applied to the straightened yarn also calls for care if precise results are to be obtained.

Two types of machine have been employed to determine the *tensile strength* of fabrics, the pendulum type and the constant specimen-rate-of-load type. The relative merits of the two and various aspects of the apparatus, such as the character and size of the jaws, the rate of speed of the pulling jaw, and calibration cannot be considered here. The capacity of the pendulum type is limited by the position of the pendulum, so that the accurate capacity may be con-

[1] *Paper No. 369,* Miscellaneous Journal Series, Minnesota Agricultural Experiment Station.

[2] Presented at a Symposium on Test Methods held during the Fall Meeting of the A.S.T.M. Committee D-13 on Textile Materials, October 20 to 22, 1937, New York City.

[3] Assistant Professor of Textiles and Clothing, Division of Home Economics, University of Minnesota, St. Paul, Minn.

[4] 1936 Book of A.S.T.M. Standards, Part II, p. 1334.

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication, or for the attention of the author. Address all communications to Society Headquarters.

[5] G. B. Haven, "Mechanical Fabrics," pp. 451, 678, John Wiley and Sons, Inc., New York City (1932).

siderably less than the stated capacity. In order to work with a variety of fabrics more than one such machine may be required, especially if tests on wet rayon are to be included.

The preparation of the sample and the way it is inserted in the jaws of the machine also are important. In the grab test the preparation of the sample is exceedingly simple, but great precision should be employed in marking it and in putting it in the machine because of the amount of bow in many fabrics. Crosswise yarns should be parallel with the top of the jaws and identical yarns in the direction of test should be grasped by both jaws. Inaccuracy in this particular may account in part for a possible lesser precision of the grab test when compared with the strip test, and probably should result in a greater number of samples being broken when this test is used.

On the other hand, while the strip test sample may be inserted in the machine with considerably greater ease than the grab test sample, it requires great precision in preparation. This in turn may account for the possible greater relative precision of the strip test, the greater uniformity of which is mentioned several times by Haven.[6] The grab method gives the higher values of the two, and is recommended for use in the General Methods (D 39 - 36) unless the strip method is specified, although some strong and very elastic fabrics cannot be broken except by the strip method.

Standard methods call for a grab test sample 4 in. wide, while Haven[7] says that, for light-weight fabrics, samples should be 5 or 6 in. wide. Working with sheeting samples 4, 3, and 2 in. wide, a student recently found 72, 77, and 75 lb. respectively, to be the mean grab strength of five replicates each. If these results are not peculiar to one piece of fabric, the same total amount of cloth could be used to increase the number of samples broken.

A cut-strip method for coated fabrics has been described in D 39 - 36 in addition to the well-known raveled-strip method. Both Heermann and Herzog,[8] and Haven[9] state that if no fringe is allowed at the sides of the strip (of uncoated fabrics) the outer yarns will be pushed out sidewise when stress is applied. A student trial with sheeting gave 55 lb. with the cut-strip method, 54 lb. with ½ in. raveled at each side, and 58 lb. with an intermediate amount of raveling. No statement is made as to the device to be used for measuring the unraveled portion of the strip test sample, but precision at this point is essential.

Tensile strength determinations are run on both dry and wet samples. Williams,[10] at the Textile Institute Conference on Serviceability of Fabrics, stated that, among customer complaints of tearing, this occurred in many cases when the fabric was wet, and that it is accordingly essential to determine the wet strength in all strength tests.

The measurement of *elongation* on a fabric under stress is made simultaneously with the tensile strength measurement. The standard methods (D 39 - 36) call for the use of a 6-oz. weight to be attached to the bottom of the test sample before the lower jaw of the testing machine is tightened. In this case a common zero point serves for both tensile strength and elongation on the graphic record. Without such a weight, elongation may be calculated from the point where the curve departs from the vertical, and with careful work this method should give satisfactory results provided the sample is not stretched when clamped in the machine. The effect on elongation of varying the width of the grab test sample, in a class trial previously mentioned, was negligible. Elongation is commonly calculated as a percentage of the original gage length of the sample, in which case no account is taken of the ease with which the fabric stretches or, in other words, the force required to produce the measured elongation.

Tearing strength also is determined with the machine used to test tensile strength, and the value is read best from the upper portion of the graphic record. Two methods have been described in D 39 - 36, while in CCC - T - 191 it is pointed out that the test may be adapted to the capacity of the available machine by tearing more than one thickness of cloth and dividing the result by the number of thicknesses used. In the latter case caution should be observed to insure uniform tension and position of the several layers when fastening them in the jaws of the machine.

Tests for *shrinkage* have been included in CCC - T - 191, in CS 59, and in the A.S.T.M. Methods of Test for Shrinkage in Laundering of Woven Cotton Cloth (D 437 - 36)[11] and for Silk and Rayon Woven Broad Goods (D 416 - 35 T).[12] These methods specify samples either 20 or 12 in. square, and call for the use of a cylindrical reversing wash wheel or of a launder-ometer. For cotton and linen fabrics the method appears to aim to duplicate commercial laundry shrinkage. Peirce,[13] in discussing this topic at the Textile Institute Conference on Serviceability, says shrinkage does not depend upon the details of the machinery used if the fabric is completely wetted out and subjected to an average amount of mechanical agitation. More important than the device used, he claims, are the details of the drying and pressing procedures which are employed. In a discussion which followed it was pointed out that the change of dimensions of a fabric is a broader aspect of the problem, and would include stretchage as well as shrinkage. In the methods mentioned the sample is to be squeezed but not wrung and then pressed with a flat bed press or under a flat sheet of metal to avoid distortion.

Finally, for the determination of *slippage*, as outlined in CS 59 and in the A.S.T.M. Tentative Method of Test for Resistance to Yarn Slippage in Silk, Rayon, and Silk-Rayon Woven Broad Goods (D 434 - 36 T)[14] a testing machine of low capacity and equipped with an autographic recording device is required. This method tests the slippage of yarns at seams and is the newest of the several fabric tests. Care should be observed in the preparation of the sample and in placing it in the machine.

Undoubtedly all of these measures, in the final analysis, could be shown to be sensitive to variations in the moisture content of the material being tested. Consequently, in considering the precision of the results to be obtained, the uniformity of the atmospheric condition to which the samples have been exposed is important. Perhaps one might

[6] G. B. Haven, *op. cit.*, pp. 409, 410, 413, 415, 416.

[7] G. B. Haven, *op. cit.*, p. 410.

[8] P. Heermann and A. Herzog, "Mikroskopische und Mechanisch—technische Textiluntersuchungen," p. 357, Julius Springer, Berlin (1931).

[9] G. B. Haven, *op. cit.*, p. 407.

[10] J. Guilfoyle Williams, "Testing and the Serviceability of Fabrics," *Journal*, Textile Inst., Vol. 28, p. P228 (1937).

[11] 1936 Book of A.S.T.M. Standards, Part II, p. 1344.

[12] *Proceedings*, Am. Soc. Testing Mats. Vol. 35, Part I, p. 1248 (1935); also 1937 Book of A.S.T.M. Tentative Standards, p. 1417.

[13] F. T. Peirce, "The Serviceability of Fabrics in Regard to Wear," *Journal*, Textile Inst., Vol. 28, p. P182 (1937).

[14] *Proceedings*, Am. Soc. Testing Mats., Vol. 35, Part I, p. 1157 (1936); also 1937 Book of A.S.T.M. Tentative Standards, p. 1419.

ask how the variability in test data which would result from a fluctuation of 10 deg. in temperature would compare with that due to differences in the manipulation of samples and testing device.

INTERPRETATION OF DATA

A third problem is the interpretation of data. Numerous illustrations could be cited from published methods of tolerances with respect to specifications, but no limits are set for the accuracy of replicates. Inter-laboratory checks have been used to insure approximate duplication of a mean value for a given method, but few records have come to hand of similar checks to determine the variability between samples or replicates from a single fabric which may be due to individual manipulation. Such variations usually are embodied in the mean value which customarily has been employed as the measure of the given property. Apparently the fabric often has borne the brunt of all variability observed, whether justly or not. The extended interest in and use of statistical analyses of data offer a convenient means of ascertaining the variability due to individual technique in testing. As intimated in the discussion of sampling, where a mean is to be used one might ask if it should not be proven that it will not change with additional samples.

The custom of using a mean value can be strengthened by the use of certain statistics which measure the variability about the mean. However, the mean might seem to be a seller's, rather than a buyer's, measure. Peirce,[15] who has been quoted above, says that the "weakest link" principle enters into the interpretation of a series of tests measuring serviceability, since the useful life of a fabric is determined by that feature which fails first. The identity of this feature which fails first, and which is the pertinent test for the fabric, he believes will vary with different fabrics, which will have been made differently, and used under different conditions of service. He further states that to use the general average of a series of tests as a measure of serviceability assumes that the serviceability of the fabric will remain intact in its entirety until at some moment it goes to pieces completely.

In conclusion some general aspects of fabric testing largely associated with the types of interests for which the testing is done might be pointed out. Is it for the manufacturer, the distributor, or the ultimate consumer? Is it for groups using heavy or mechanical fabrics, or for those concerned with clothing materials? From the history and development of such testing, many methods appear to have been developed and evaluated primarily in terms of heavy fabrics. In recent years these methods may have been used for an increasing number of medium and light-weight materials.

Again certain specifications refer to fabrics either in equilibrium with a standard atmosphere or wet. Are there not situations where the test should be made on a sizing-free and unstrained or relaxed sample, in other words, on one from which the effects of finishing have been removed as they will be during use? Are there any implications for the testing laboratory in the custom among distributors and retailers of quoting gray goods specifications on sheetings and shirtings to the over-the-counter buyer? One reason given for this has been that the effects of finishing are not uniform, and so forth. If that is true how about testing in the "finished" state? Are the interests of these different groups involved here?

Finally have these tests been developed so as to serve as many different interests as possible? Are they set up so that a large investment in specialized equipment is a preliminary requisite and is this unavoidable in every instance? Is there no place for alternate methods in certain cases, such as shrinkage, or color fastness to laundering, which would permit the use of ordinary chemical laboratory equipment and which would more nearly duplicate home laundering?

It may be that in these questions there are involved the aims and interests of those groups which have been instrumental in the development and use of fabric tests. Possibly the growth of consumer interest in such tests as measures of serviceability will lead to a new phase in the evolution of fabric testing.

[15] F. T. Peirce, *op. cit.*, p. P190.

Laboratories Form an Association

REPRESENTATIVES of twenty of the principal commercial laboratories of the country, at a recent meeting in Chicago, completed the organization of the American Council of Commercial Laboratories, one of whose purposes will be the promotion of the proper use of scientific testing methods for the protection and certification of quality in advertised goods.

The announcement of the Council states that the members have been and will be carefully selected to include only organizations to which producers, retailers and consumers may look for unbiased determinations of quality. Engaging in research and testing for fees these independent laboratories ascertain and report facts for clients and are uninfluenced by any ulterior consideration.

Laboratories which are adjuncts of other enterprises, or which are not self-supporting, or which, for any reason are not independent are ineligible for membership.

The following officers and members of an executive committee were elected to serve during 1938:

President: Preston S. Millar, Electrical Testing Laboratories, New York.

Vice-president: Monroe L. Patzig, Patzig Testing Laboratories, Des Moines, Iowa.

Secretary: D. E. Douty, United States Testing Co., Hoboken, N. J.

Treasurer: A. R. Ellis, Pittsburgh Testing Laboratory, Pittsburgh, Pa.

Members of Executive Committee:

James H. Herron, The James H. Herron Co., Cleveland, Ohio.

F. B. Porter, Southwestern Laboratories, Fort Worth, Texas.

T. A. Wright, Lucius Pitkin, Inc., New York.

Permanent Value

IN this issue there will be found a condensed table of contents for the BULLETINS issued in 1937. This may be of service to many members, as an index to the BULLETINS for the year. At the same time, it focuses attention on one interesting fact—that many of the papers and articles in the BULLETIN have permanent or quasi-permanent value. The BULLETIN is so made up that papers, reports and other items which it can be assumed a fair proportion of the members might wish to save begin on right-hand (odd-numbered pages) to facilitate extraction and filing.

XVII. Long-Time Society Committee Members

Seventeenth in the Series of Notes on Long-Time Members

There are presented below as a continuation of the series of articles in the ASTM BULLETIN comprising notes on the outstanding activities of long-time A.S.T.M. members, outlines of the work of three additional members. In general the men whose activities are described in this series have been affiliated with the Society for 25 years or more and have taken part in committee work for long periods of time. No definite sequence is being followed in these articles.

MAXIMILIAN TOCH, President and Chief Chemist, Toch Brothers, Inc., New York City, attended New York University, Cooper Union and Columbia University and participated in special lectures at Charlottenberg, Berlin, and University of Basel, Switzerland. He has earned several degrees including B.S., Ch.E., Ll.B., and D.Sc. He is a Fellow of the Royal Photographic Society and also of the London Chemical Society.

Doctor Toch's most important work has been in the paint and varnish field where he has undertaken pioneering work on china wood oil, 1896 to 1902, and use of soybean oil and perilla oil and its composition. He was one of the first to classify various fish oils for paint uses and was first investigator of pine oil as a paint material.

H. C. Jennison Maximilian Toch John Howe Hall

His membership in A.S.T.M. dates from 1903. While his major committee activities have concerned Committee D-1 on Paint, Varnish, Lacquer, and Related Products with which he has been affiliated since 1910, he was a member in the very early years of Committee D-8 on Bituminous Waterproofing and Roofing Materials, serving until 1924. He took a leading part in the inspection of the Havre de Grace bridge test conducted by Committee D-1, and was active in the early work of the subgroup on testing of paint vehicles.

He is the author of "Chemistry and Technology of Paint," "Materials for Permanent Painting" and other volumes, and has contributed numerous papers and reports to Society and other publications. At the present time he is Professor of the Chemistry of Fine Arts at the National Academy of Design and is Honorary Professor of Chemistry at the University of Peking, China, with special reference to china wood oil.

H. C. JENNISON, Technical Manager, The American Brass Co., Waterbury, Conn., has been connected with this company since 1900, first as Laboratory Assistant, then Testing Engineer, from 1919 to 1923 as Technical Supervisor, then becoming Technical Superintendent. In 1934 on the death of W. H. Bassett, Mr. Jennison succeeded him in his present position. Since 1923 he had been Mr. Bassett's active assistant.

His early education was obtained in the schools of Bridgeport, Conn., this being supplemented by active outside studies. Since his direct association with Mr. Bassett he has been concerned with the work of numerous Society committees and is at present a member of numerous groups, particularly those in the non-ferrous metals field including Committees B-1 on Copper and Copper Alloy Wires, B-2 on Non-Ferrous Metals and Alloys, and B-5 on Copper and Copper Alloys, Cast and Wrought. He represents the Society on the Joint Committee on Trolley Wire Specifications and also on the Non-Ferrous Metals Division of the Society of Automotive Engineers. He is a member of the Metallurgical Advisory Board of the Ordnance Department, Washington, and also of the Bureau of Standards Metallurgical Advisory Board.

In addition to his membership in the A.S.T.M., which dates from 1909, he holds membership in the American Institute of Mining and Metallurgical Engineers, British Institute of Metals, American Institute of Electrical Engineers, and Electrochemical Society.

JOHN HOWE HALL, who has recently established a consulting engineering practice in Philadelphia, prior to which he was for several years Assistant to the President of the Taylor-Wharton Iron and Steel Co., Easton, Pa., was graduated from Harvard University in the Class of 1903. He received his bachelor's degree and also earned his master's degree with four years' work. He spent a fifth year in Harvard doing research work under Professor Sauveur, who was in charge of several courses which Mr. Hall took during his four years at the University. He was later employed by the Bethlehem Steel Co. and the Buffalo Crucible Castings Co., and in December, 1906, entered the laboratory of the Taylor-Wharton Iron and Steel Co., with which company he was affiliated, with the exception of 1913 to 1914 when he was consulting metallurgist in New York City, until his resignation late in 1937.

During his early years in Easton he worked with his uncle, the late Henry M. Howe. Much of his work has consisted of laboratory investigation of new metals and products, and also active development of new processes, design of new equipment and establishing manufacturing procedure. He is responsible for a number of developments, particularly with respect to manganese and other alloy steels.

In the Society he has been particularly active in the work of Committee A-1 on Steel, especially Subcommittee VIII on Steel Castings; Committee A-3 on Cast Iron and from 1913 until the committee was disbanded (1934) he was secretary and vice-chairman of the committee on heat treatment of iron and steel. At present he is also serving on Committee E-6 on Papers and Publications, and represents the A.S.T.M. on the Handbook Committee of the American Society for Metals.

Especially active in the work of the American Foundrymen's Assn., he is an honorary life member, and was awarded the first Whiting Medal in 1924. He presented the Henry M. Howe Memorial Lecture of the American Institute of Mining and Metallurgical Engineers in 1929.

The Need for pH Standards[1,2]

By Baker Wingfield[3], W. H. Goss[3], Walter J. Hamer[3], and S. F. Acree[3]

WHAT is the practical value of a pH measurement if corrections for the electrolytes and temperature changes and the inherent errors in the electrodes (half-cells), buffer and color standards, measuring apparatus and methods are not known? It means at best only a rough approximation which is not satisfactory for comparison with values obtained in different laboratories. For example, reports on the pH values of samples of the same material sent to twelve laboratories were found to be roughly divided into two groups about 0.15 pH apart.

The growing importance of pH in industrial and scientific work presents the necessity and the opportunity for placing the entire subject on a coordinated fundamental and practical basis. This program should be carried out at a centralized agency by first establishing and then maintaining suitable primary standards for research to within ±0.001 pH and for calibration of secondary or practical standards to within ±0.01 pH. The relation of practical pH values to those obtained on the activity basis should be established and the numerous sources of errors in measurements investigated.

A few of the uncertainties in the measurement and meaning of pH are discussed briefly in the following sections to show the need for further coordinated work in these fields and the establishment of accurate pH standards and methods.

ELECTROMETRIC MEASUREMENTS

There are a number of electrode (half-cell) combinations which are used in pH measurements, but for brevity the discussion will be limited to glass electrode systems as a typical case.

An electrometric system frequently employed for pH determinations includes a saturated calomel electrode (half-cell), a liquid junction, the solution whose pH is to be determined, and a glass electrode (half-cell). This system should give concordant pH values, but reports from various laboratories have shown otherwise. These discrepancies are usually due to lack of proper shielding of the electrical assembly, errors inherent in the electrodes such as hysteresis, asymmetry potentials and impurities, and the various methods employed in constructing the liquid junction. It is obvious that significant comparisons and interpretations of pH measurements cannot be made until certain types of assemblies have been shown to give concordant results and are then universally agreed upon and employed. In order to establish standard assemblies, there is need for a systematic study of present ones and a determination of the magnitude of the total errors and those inherent in the various parts of the different assemblies.

[1] Publication approved by the Director of the National Bureau of Standards of the U. S. Department of Commerce.

[2] This article is an abstract of an address presented at the Fortieth Annual Meeting of the Society, July 1, 1937, New York City.

[3] Respectively Assistant Chemist, National Bureau of Standards; Junior Chemical Engineer, U. S. Department of Agriculture, now at Experiment Station, University of Illinois; Associate Chemist, National Bureau of Standards; and Chief of Fiber Structure Section, National Bureau of Standards, Washington, D. C.

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication, or for the attention of the author. Address all communications to Society Headquarters.

Electrical Instruments and Shielding:

Various methods of measuring d.c. potentials in circuits of high or low resistance have been proposed. These employ the ballistic galvanometer, high sensitivity deflecting galvanometers, quadrant electrometers, and electronic devices[4]. In all of these methods, shielding and housing are essential for precise work. It has been found that d.c. amplifier systems which have been properly shielded and grounded will detect 0.1 mv. with glass electrodes having 100 megohms resistances.[5] There is need for improvement of simple devices now available in order to obtain comparable results. A method of shielding a simple electrical assembly including a sensitive galvanometer and potentiometer without vacuum tube amplification has been used with success at the National Bureau of Standards[5]. With this shielded system, the disturbing effects in the circuit were reduced to such an extent that potential differences between two glass membranes could be measured to the precision illustrated in Table I.

TABLE I.—SENSITIVITY OF GALVANOMETERS AND PRECISION IN ELECTROMOTIVE FORCE MEASUREMENTS OBTAINED WITH A SHIELDED TYPE *K* POTENTIOMETER AND TWO GLASS ELECTRODES HAVING A TOTAL RESISTANCE OF 12 MEGOHMS.

Galvanometer, Suspension Type	Rated[a] Sensitivity, Microamperes	Voltage on Either Side of the Zero Point Required to Give a Noticeable Galvanometer Deflection, Millivolts
A-1	0.003	2 to 4
A-2	0.0005	0.4 to 0.6
A-3	0.0001	0.2
B-4	0.00001	0.01 to 0.05

[a] Microamperes per millimeter at 1 m.

In electromotive force measurements, it has also been found necessary to enclose both the reference and glass half-cells in a grounded wire cage to obtain steady readings when there are other electrical devices in the room. With this potentiometric equipment and a galvanometer sensitive to 0.0001 μ a, readings on glass half-cells up to 12 megohms resistance can be readily made to well within ±0.5 mv. Further work is needed to increase the precision obtainable by such simple devices.

Reference Half-Cells:

Errors in reference half-cells are specific for the type employed. The predominating error of calomel electrodes is

[4] F. Müller, "Electromotive Force Measurements with the aid of Electron Tubes," *Transactions*, Electrochemical Soc., Vol. 62, p. 335 (1932). R. H. Cherry, "The Measurement of Direct Potentials Originating in Circuits of High Resistance," *Transactions*, Electrochemical Soc., Vol. 72, p. 173 (1937), give reviews.

[5] J. O. Burton, H. Matheson and S. F. Acree, "A Glass Electrode Potentiometer System for the Determination of the pH Values of Weakly Buffered Solutions Such as Natural and Treated Waters," *Journal of Research*, Nat. Bureau Standards, Vol. 12, p. 67 (1934), Research Paper 634.

hysteresis. In a recent publication[6] it was shown that errors due to hysteresis in saturated and slightly undersaturated half-cells may amount to from 0.5 to 0.9 mv. when the temperature change is 6 to 8 C. at a rate of 4 to 5 C. per hr., and the temperature of the electrode is taken as that of its KCl solution. In addition it requires several hours after a temperature change for the potential to come within 0.2 to 0.3 mv. of the equilibrium value. The hysteresis and time-lag preclude the possibility of obtaining concordant pH results to a precision of ± 0.01 pH unit with use of the calomel electrode unless constant temperature is maintained and sufficient time allowed for equilibrium. Since in practice this is often inconvenient, there is a need for data which will aid in correcting for these effects, and additional study of other electrodes to find a type having negligible hysteresis and time-lag. Measurements with silver chloride electrodes under controlled conditions have shown that this electrode nearly satisfies these requirements, but further work is needed to ascertain if this holds true for routine procedures.

Housing the calomel half-cells in dewar flasks does not entirely eliminate the hysteresis, but the use of these flasks in the case of fluctuating temperatures is recommended.

Glass Electrodes or Half-Cells:

Various types of Corning 015 glass electrodes or half-cells are in use for containing, stabbing, dipping into, or contacting the surface of the material whose pH is to be determined. The glass is generally blown into some form of thin container, inside of which is housed an "internal" reference half-cell, and the entire unit is called a glass electrode or half-cell. The electromotive force measurement is made between the internal and an external reference half-cell. Current, therefore, flows through the glass wall, the resistance of which may be between 5 and 1000 megohms, so that the precision of the electrometric pH measurements also varies widely.

(*a*) *Asymmetry Potentials of Glass Half-Cells.*—Blowing the glass into the desired forms produces strains and possibly chemical changes which lead to a changing difference or hysteresis between the potentials of the inner and outer surfaces of the glass wall toward the same solution. These so-called asymmetry potentials have been reported to vary from 0.1 to 95 mv. but are generally only a few millivolts after soaking the glass half-cell several days in water or buffers. The glass itself is subject to deterioration and failure to function normally toward hydrogen ions.

Because of these properties of the glass, the glass half-cell can be used only as a secondary standard and must be calibrated frequently (hourly) during use for precise work. The usual method of calibration is to determine the pH values of a series of buffers with the primary hydrogen electrode and a saturated calomel half-cell, and make a calibration plot of these known pH values of the buffers against their e.m.f. readings with the glass and calomel half-cells. From this plot, the pH of an unknown is obtained from its e.m.f. reading toward the same half-cells. Neutral salts, colloids, and organic materials, may also affect e.m.f. readings of glass electrodes, and systematic studies of these effects are needed. It is quite well established, however, that glass electrodes are unaffected by oxidation-reduction potentials.

Table II shows the asymmetry potential of three typical 1-in. diameter glass bulbs (wall thickness 0.02 to 0.04 mm.) which were made up and tested with permanent internal and temporary external Hg|HgCl|0.1 *N* HCl reference half-cells. These measurements were made with a type *K* shielded potentiometer and a galvanometer having a sensitivity of 0.0001 μa per mm. Although the changes after four days are small, they show the need for constant calibrations and research on annealing and chemical treatments to reduce this source of error.

TABLE II.—CHANGES DURING 45 DAYS IN THE ASYMMETRY POTENTIALS OF THREE 25-MM. BULB ELECTRODES WITH 0.1 *N* HCl INSIDE AND OUTSIDE THE BULBS. THE VALUES ARE GIVEN IN MILLIVOLTS.[a]

Days in 0.1 *N* HCl	4	8	10	12	14	20	25	45
Cell No. 1	0.0	+2.7	−0.1	−1.7	−1.2	−1.3	−1.8	−2.1
Cell No. 2	+1.1	0.0	0.0	−1.7	−2.5	−0.0	−0.6	−4.8
Cell No. 3	−6.9	−7.4	−7.1	−7.9	−7.6	−5.9	−5.9	−5.1

[a] The sign is that of the inner wall surface.

(*b*) *Calibration of Glass Half-Cells.* — In routine pH measurements with glass half-cells there may be interaction between the cations of the glass and the solution, adsorption of ions and colloids, and other factors causing errors. It is therefore good practice to store the electrodes in buffers having compositions and pH values approximately those of the solution to be measured, and to immerse and check the electrode in three or four successive portions of the unknown to secure constant electromotive force readings. This can be done readily in factory control of liquids of fairly constant composition. If the glass electrode must be used extensively in liquids having a wide variety of pH values and compositions, the calibrations are less reliable and must be made frequently, at least once a day or oftener during use. Table III shows the variations within 10 days in the calibrations of an electrode used with viscous agar media, distilled water, buffers, etc., and requiring cleaning with a brush or cotton between measurements. The hysteresis of the internal reference electrode due to extensive handling doubtless contributed to the changes in calibration. The plot of the pH *versus* the electromotive force was constant in slope, although variable in position, showing that the electrode had not deteriorated but that the curve merely reflected transient disturbances.

TABLE III.—CALIBRATION VALUES (IN MILLIVOLTS) OF A GLASS HALF-CELL IN THE SYSTEM Hg|HgCl|0.1 *N* HCl|GLASS|BUFFER|SATURATED KCl|HgCl|Hg.

pH of Buffer	3.00	5.00	7.00	Number of pH Determinations Made Since Last Calibration.[a]
0 days	59.7	175.0	295.0	0
1 day	60.9	178.5	296.1	21
2 days	62.7	180.1	297.5	22
8 days	64.3	.....	.....	30
9 days	54.5	171.7	288.9	30
10 days	47.0	161.1	281.6	18

[a] Each calibration and pH determination involved handling and disturbance of the two half-cells.

[6] B. Wingfield and S. F. Acree, "Temperatures and Hysteresis Errors in Calomel Half-Cells," *Journal of Research,* Nat. Bureau Standards, Vol. 19, p. 163 (1937), Research Paper 1018; "Some Electrometric pH Equipment and Hysteresis of Calomel Electrodes," *Journal,* Am. Leather Chemists' Assn., Vol. 31, p. 403 (1936).

When the glass and calomel half-cells are maintained at constant temperature and are subject to very little handling, the rate of change in their calibrations is smaller than when they are frequently moved. This is indicated by comparison of the data in Table IV with those in Table III. If the glass and calomel half-cells are separate units they should be rigidly mounted and the solution or wash water brought upward in a container to surround them. It is preferable to build both half-cells in unit apparatus which can be rigidly mounted and bathed with solution or wash water without handling the half-cells.[6]

TABLE IV.—CALIBRATION VALUES (IN MILLIVOLTS) OF GLASS-CALOMEL CELLS STORED AND TESTED DURING SEVERAL MONTHS AT 25C WITHOUT HANDLING.

(*The bulbs were about 25 mm. in diameter*)

System: Au | Quinhydrone | 0.1 *N* HCl | Glass | Buffer | Saturated KCl | HgCl | Hg				
pH of Buffer	3.00	5.00	5.00	7.00
0 days	266	147	130[a]	27
21 days	...	...	104	...
32 days	262	143	...	22
92 days	245	124	...	3

System: Hg | HgCl | 0.1 *N* HCl | Glass | Buffer | Saturated KCl | HgCl | Hg			
pH of Buffer	3.00	5.00	7.00
0 days	26	145	264
136 days	22	140	258
206 days	9	126	244

[a] Micro bulbs of 4-mm. diameter.

The reproducibility of electromotive force readings, or pH values, with four calibrated glass half-cells used in regular work is illustrated in Table V for four typical solutions. Table V shows that the electromotive force data are generally reliable to within 1 mv. for 0.001 to 0.1 *M* buffers, but may vary 2 or 3 mv. for very dilute or weakly buffered solutions such as distilled water or tap water.

TABLE V.—REPRODUCIBILITY OF ELECTROMOTIVE FORCE READINGS OBTAINED WITH FOUR CALIBRATED 25-MM. DIAMETER BULB GLASS HALF-CELLS IN FOUR TYPICAL SOLUTIONS.

Electrode	M/40 Buffer, pH =4.50	M/1000 Buffer, pH =3.83	Tap Water, pH =7.24	Distilled Water, pH =6.30
	Millivolts			
No. 1	138.5	75.5	294	80.5
No. 2	139.0	75.0	296	82.0
No. 3	139.0	75.0	298	....
No. 4	139.0	....	298	....

(*c*) *Resistance of Glass Half-Cells.*—As the resistance of the wall of the glass half-cell and the polarization capacitance in both a.c. and d.c. measurements affect the precision of the electromotive force or pH readings,[7] work on these factors is needed. For example, very small known currents were run through a glass half-cell, with the same solution and platinum electrodes inside and outside, and the electromotive force drop across the thin glass wall was measured with a vacuum tube potentiometer. The resistance of the half-cell wall was calculated as usual. By reversing the current at very short intervals with suitable tapping keys, the polarization was reduced. Under these conditions one of the glass half-cells showed resistances of 3.3, 3.4, 3.3, and 3.3 megohms at voltage drops of 5, 340, 690, and 1280 mv. across the glass film. But by use of continuous currents the same half-cell showed apparent resistances of 9.5 to 16.9 megohms. In pH measurements with glass half-cells, therefore, the error due to reverse polarization voltage is to be avoided by quickly tapping the keys until balance is obtained.

Liquid Junctions:

The elimination of the error due to liquid junctions is difficult and necessitates research of a fundamental nature. The potential known to exist at the junction of any two electrolytic solutions arises from the unequal ionic mobilities and the different rates of diffusion of the ions across the junction. The magnitude of this potential also depends upon the manner in which the junction is constructed. For example, the potential of the junction between 0.10 *N* HCl and 0.10 *N* KCl was found to be 0.0278 v. by Myers and Acree,[8] Lewis, Brighton, and Sebastian,[8] and Bjerrum[8] for the stationary type of junction. For the flowing junction, MacInnes and Yeh,[9] Roberts and Fenwick,[9] and Ghosh,[9] respectively, obtained 0.02678 v., 0.0280 v. and 0.02827 v. The latter values show marked differences, ow-

[7] W. A. Taylor and S. F. Acree, "Studies in the Measurement of the Electrical Conductivity of Solutions," *Science*, Vol. 42, (September 17, 1915); p. 1081, 388-390; "Studies in the Measurement of the Electrical Conductivity of Solutions of Different Frequencies. V. Investigations on the Use of the Vreeland Oscillator and Other Sources of Current for Conductivity Measurements," *Journal*, Am. Chemical Soc., Vol. 38, p. 2396 (1916); VI. "Investigations on Bridge Methods, Resistances, Cells, Capacities, Inductances, Phase Relations, Precision of Measurements, and a Comparison of the Resistances Obtained by the Use of Inductance and Capacity Bridges," *Journal*, Am. Chemical Soc., Vol. 38, p. 2403 (1916); VII. "Investigations on the True and Apparent Resistances, Voltage, Apparent Capacity, Size and Character of Electrodes, Ratio of Inductance Changes to Resistance Changes, and the Relation of Induction and Capacity to Frequency," *Journal*, Am. Chemical Soc., Vol. 38, p. 2415 (1916).

T. Shedlovsky, "A Screened Bridge for the Measurement of Electrolytic Conductance, I. Theory of Capacity Errors. II. Description of the Bridge," *Journal*, Am. Chemical Soc., Vol. 52, p. 1793 (1930); "A Conductivity Cell for Eliminating Electrode Effects in Measurements of Electrolytic Conductance," *Journal*, Am. Chemical Soc., Vol. 52, p. 1806 (1930).

G. Jones and R. C. Josephs, "The Measurement of the Conductance of Electrolytes. I. An Experimental and Theoretical Study of Principles of Design of the Wheatstone Bridge for Use with Alternating Currents and an Improved Form of Direct Reading Alternating Current Bridge," *Journal*, Am. Chemical Soc., Vol. 50, p. 1049 (1928).

G. Jones and F. C. Jelen, "The Conductance of Aqueous Solutions as a Function of the Concentration. II. Potassium Ferrocyanide," *Journal*, Am. Chemical Soc., Vol. 53, p. 2561 (1936).

G. Jones and M. J. Prendergast, "The Measurement of the Conductance of Electrolytes. VII. A Redetermination of the Conductance of Kohlrausch's Standard Potassium Chloride Solutions in Absolute Units," *Journal*, Am. Chemical Soc., Vol. 59, p. 731 (1937).

[8] C. N. Myers and S. F. Acree, "A Study of the Hydrogen Electrode, of the Calomel Electrode and of Contact Potential," *American Chemical Journal*, Vol. 50, p. 396 (1913).

G. N. Lewis, T. B. Brighton, and R. L. Sebastian, "A Study of Hydrogen and Calomel Electrode," *Journal*, Am. Chemical Soc., Vol. 39, p. 2245 (1917).

N. Bjerrum, "Über die Gultigkeit der Planckachen Formel für das Diffusionpotential," *Zeitschrift für Elektrochemie und angewandte Physikalische Chemie*, Vol. 17, p. 58 (1911).

[9] D. A. MacInnes and Y. L. Yeh, "The Potentials at the Junctions of Monovalent Chloride Solutions," *Journal*, Am. Chemical Soc., Vol. 43, p. 2563 (1921).

E. J. Roberts and F. Fenwick, "A Simple Type of Flowing Junction," *Journal*, Am. Chemical Soc., Vol. 49, p. 2787 (1927).

D. N. Ghosh, "A New Type of Liquid-Liquid Junction," *Journal*, Indian Chemical Soc., Vol. 12, p. 15 (1935).

ing to the varying manner in which the flow was produced and regulated.[10] Additional studies are needed to establish a standard type of junction.

Certain involved methods[11] have been used to estimate the magnitude of liquid junction potentials. These values have shown that the potential for junctions of weak buffers and saturated KCl vary from 2 to 4 mv. and for junctions between strong acids and saturated KCl vary from 3 to 10 mv. Less involved methods[12] have also been employed but they give at best only approximate results. These methods require a knowledge of ionic mobilities and transference numbers. Further work is required to determine the magnitude of the potential arising from the junction between typical solutions and KCl or *iso*electric mixtures such as $3N$ KCl||$1N$ KNO_3 and to perfect a pH method which will be independent of all liquid junctions. One electrometric pH method independent of all liquid junctions involves the use of a silver chloride electrode and the addition of a chloride to the unknown.[13] This method is under investigation at the National Bureau of Standards, and extensive measurements are needed to establish its general practicability.

COLORIMETRIC METHODS

Certain organic dyes, called indicators, change color within narrow ranges of acidity. These are very convenient secondary pH standards which now have wide application. In order that pH data obtained by their use may be comparable with electrometric pH standards, more data are needed on the influence on the sample of the pH of the indicator itself, on salt effects, protein effects, and on the errors inherent in the photometric equipment and methods. The error due to the pH of the indicator itself is small, except for dilute or unbuffered solutions, which can be tested by the *iso*hydric indicator method.[14]

Electrolytes may affect all the colored forms of the indicator, such as quinone and quinonephenolate groups, and to different degrees. In order to study the magnitude of these salt errors for a simple quinone form of dye, preliminary measurements were made with a recording spectrophotometer on solutions containing 0.0003 M β-naphthoquinone sodium sulfonate dye and various salts in concentrations ranging from 0.005 M to 2.0 M, together with 0.005 M HCl as a stabilizer. The deviation from unity of the ratio of the absorption index N of the solution containing salt to that of the standard containing only dye and 0.005 M HCl ($N_{0.005\ M\ HCl}$) was used as a measure of the salt error. When this ratio is unity the salt error is zero. In Fig. 1 these index ratios are plotted against the negative logarithm of the mean molar activities $A\pm$[15] of the salt plus acid. Although the conversion of molar salt concentration to salt activity corrects for the valence factor, the curves do not coincide. The deviations are probably due in part to stepwise ionization and specific effects of the salts. In general, however, the salt error increases as the salt concentration becomes larger and log $(1/A\pm)$ smaller.

In addition to studies of these salt errors, further work is needed on the establishment of glass and liquid pH color standards, on color filters, and on photometric methods and equipment.

STANDARDS IN ORGANIC SOLVENTS

In addition to the above discussion of standards in aqueous solutions, consideration must be given to the various

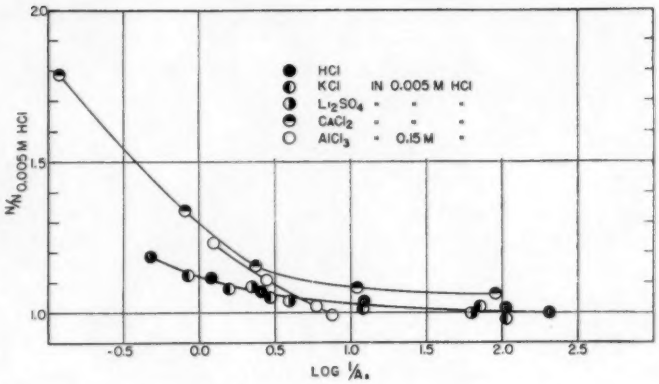


Fig. 1.—Plot of the Index Ratio, $N/N_{0.005M\ HCl}$, Against the Logarithm of the Reciprocal of the Mean Molar Activities, Log $(1/A\pm)$, of the Salt Plus Acid

classes of non-aqueous liquids, especially the alcohols, benzene, petroleum fractions, etc., now widely used as solvents. The dielectric constants, viscosities, association, polarity, and other physico-chemical properties of these organic solvents are as a rule considerably different from those of water. Electrolytes dissolved in organic liquids have, as a rule, far smaller ionization or activity than in correspond-

---

[10] A. B. Lamb and A. T. Larson, "Reproducible Liquid Junction Potentials; the Flowing Junction," *Journal*, Am. Chemical Soc., Vol. 42, p. 229 (1920).

[11] W. J. Hamer, "Application of Halide Reference Half-Cells to pH Determinations," *Transactions*, Electrochemical Soc., Vol. 72, p. 258 (1927).

D. A. MacInnes and L. G. Longsworth, "The Potentials of Galvanic Cells with Liquid Junctions," Cold Spring Harbor Symposia on Quantitative Biology, Vol. 4 (1936).

H. S. Harned, "Individual Thermodynamic Behaviors of Ions in Concentrated Solutions Including a Discussion of the Thermodynamic Method of Computing Liquid Junctions," *Journal of Physical Chemistry*, Vol. 30, p. 433 (1926).

[12] P. Henderson, "Zur Thermodynamick der Flussighkeitsketten," *Zeitschrift für Physikalische Chemie*, Vol. 59, p. 118 (1907).

G. N. Lewis and L. W. Sargent, "Potentials Between Liquids," *Journal*, Am. Chemical Soc., Vol. 31, p. 363 (1909).

C. N. Murray and S. F. Acree, "The Use of Saturated Ammonium Chloride in the Elimination of Contact Potentials," *Journal of Research*, Nat. Bureau Standards, Vol. 7, p. 713 (1931), Research Paper 369.

W. J. Hamer and S. F. Acree, "Effects of Corrections for Liquid-Junction Potentials of Saturated Calomel Electrodes on Dissociation Constants Obtained by Electrometric Titration," *Journal of Research*, Nat. Bureau Standards, Vol. 16, p. 575 (1936), Research Paper 895.

[13] E. A. Guggenheim, "Studies of Cells With Liquid-Junctions, Part II. Thermodynamic Significance and Relationship to Activity Coefficients," *Journal of Physical Chemistry*, Vol. 34, p. 1758 (1930).

D. I. Hitchcock, "A Measure of Acidity Obtained from the Electromotive Force of a Cell Without Liquid Junction," *Journal*, Am. Chemical Soc., Vol. 58, p. 855 (1936).

W. J. Hamer, "The Ionization Constant and Heat of Ionization of the Bisulfate Ion from Electromotive Force Measurements," *Journal*, Am. Chemical Soc., Vol. 56, p. 860 (1934); "Application of Halide Reference Half-cells to pH Determinations," *Transactions*, Electrochemical Soc., Vol. 72, p. 276 (1937).

[14] E. H. Fawcett and S. F. Acree, "Isohydric Indicators and Super-pure Water," *Journal of Industrial and Engineering Chemistry*, Analytical Edition, Vol. 2, p. 78 (1930); "The Problem of Dilution in Colorimetric H-ion Measurements. I. Isohydric Indicator Methods for Accurate Determination of pH in Very Dilute Solutions," *Journal of Bacteriology*, Vol. 17, p. 168 (1929).

S. Stene, "A Simplification of the Isohydric Indicator Method," *Journal of Industrial and Engineering Chemistry*, Analytical Edition, Vol. 8, p. 398 (1936).

[15] The ± sign indicates that both positive and negative ions are involved.

ing aqueous solutions, and different methods of measurement show lack of agreement. It is shown in Table VI that ethyl alcohol, for example, changes the properties of buffers and indicators, and hence the apparent pH values. Similar data were obtained with glycerine, glycol, and dioxane. It is apparent from Table VI that extensive work with organic and corresponding aqueous-organic solvents is imperative for both theoretical and practical reasons.

TABLE VI.—APPARENT pH OF 0.025 *M* SUCCINATE BUFFER (pH 4.5) MIXED WITH ORGANIC SOLVENTS AND MEASURED WITH A GLASS ELECTRODE AND WITH BROMPHENOL BLUE.

Organic Liquid	Concentration of Organic Liquid by Volume Per Cent	Electromotive Force Readings, Millivolts	Apparent pH by Glass Electrode	Apparent pH, Colorimetric
	0	139.0	4.50	4.4
Ethyl alcohol	25	114.5	4.93	4.4
	50	73.5	5.64	4.4
	75	21.5	6.54	4.4
	25	132	4.62	4.5
Glycerol	50	120	4.83	4.5
	75	103	5.13	4.6
	25	111	4.97	4.3
Dioxane	50	69.5	5.69	4.2
	75	32	6.34	....
	25	163.5	4.89	....
Diethylene glycol	50	132.0	5.44	....
	75	95	6.06	....
	25	172.3	4.75	....
Ethylene glycol	50	155	5.05	....
	75	131	5.46	....

One of the best methods for the determination of the neutral point and the degrees of association of ions in various solvents is the conductivity method. More work is needed on the perfection of the electrical equipment, on the proper corrections for electrode capacitance of the conductivity cell, and on the proper interpretation of the data.[7]

HYDROGEN ION ACTIVITY

Frequently, it is desirable to compare *hydrogen ion concentration* and *hydrogen ion activity*. Since the *activity* is equal to the product of the concentration and a factor termed the "activity coefficient," this comparison is made possible by measurements of the latter. For ideal solutions, the *hydrogen ion concentration* and *hydrogen ion activity* are equal. For most solutions, the ratio of the *hydrogen ion activity* to *hydrogen ion concentration*, called the "activity coefficient," is less than unity. The latter varies with the concentration in a manner characteristic of electrolytes and research is needed to determine this variation. From thermodynamics we cannot calculate precisely the *activity coefficient* of an individual ion. Therefore, in order to make the above comparison, there is a need to measure a large number of *mean activity coefficients* of typical electrolytes from which individual ionic *activity coefficients* may be estimated by the methods now in use.[16]

At this point, it is well to mention that there still remains the question whether the usual pH methods give a measure of *hydrogen ion concentration* or *hydrogen ion activity*. Considerable difference of opinion is evidenced on this question. Suffice it to say that further work is needed to decide this question before a true standardization of the pH scale on any basis can become a reality.

STANDARDIZATION OF pH SCALE

A standardization of the pH scale is greatly needed. The present one has been constructed mainly from electrometric measurements including liquid junction potentials for which no corrections were made, and from indicator measurements neglecting the uncertainties mentioned above. Furthermore, the present scale is based on a temperature of 25 C. and its application at other temperatures gives only approximate results. It is known that the pH of pure water is 7.4, 7.0, 6.5, and 5.7 at 0, 25, 60, and 218 C., respectively,[17] and that the pH values of buffers change in various degrees with the temperature. It is obvious that the application of a pH scale for 25 C. to other temperatures leads not only to appreciable errors but to misinterpretations as to the acidity or alkalinity. There is a need to establish a standard pH scale from electrometric measurements independent of liquid junction potentials and for a wide temperature range. This may be conveniently done by means of the primary hydrogen and silver chloride electrodes. Some pH measurements obtained to $\pm$ 0.001 in this way have been made for malonate buffer solutions and are given in a dissertation by J. O. Burton,[18] Further work along this line is in progress. At the same time, the present scale based on electrometric measurements with liquid junction potentials should be reinvestigated and extended to other temperatures in order to determine the errors of the old scale and to construct tables of these errors. A standardization of the pH scale on the two bases will give further information on the difference between *hydrogen ion concentration* and *hydrogen ion activity* and aid in eliminating many of the inconsistencies in pH work.

A PROPOSED COOPERATIVE PROGRAM ON pH STANDARDS

In view of the need for further work to develop fundamental and secondary pH standards and provide means for calibration of pH apparatus, and distribute information thereon, the following brief outline of a research program involving electrometric, spectrophotometric, conductimetric and related methods is presented for consideration as cooperative work by national organizations, institutions, and the National Bureau of Standards.

Physical-Chemical Properties of Pure Water:

Precise data on the following properties of pure water from 0 to 374 C. (critical temperature) should be made available: ionization constants, dielectric constants, viscosi-

---

[16] D. A. MacInnes, "Activities of the Ions of Strong Electrolytes," *Journal*, Am. Chemical Soc., Vol. 41, p. 1086 (1919).

E. A. Guggenheim, "Studies of Cells with Liquid-Liquid Junctions. Part II. Thermodynamic Significance and Relationship to Activity Coefficients," *Journal of Physical Chemistry*, Vol. 34, p. 1758 (1930).

J. O. Burton, W. J. Hamer and S. F. Acree, "Dissociation Constants of Malonic Acid in its Sodium-Salt Solutions at 25° C. from Electrometric Titration Measurements," *Journal of Research*, Nat. Bureau Standards, Vol. 16, p. 575 (1936), Research Paper 895.

[17] H. S. Harned and W. J. Hamer, "The Ionization Constant of Water and the Dissociation of Water in Potassium Chloride Solutions from Electromotive Forces of Cells without Liquid Junction," *Journal*, Am. Chemical Soc., Vol. 55, p. 2194 (1933); "The Thermodynamics of Ionized Water in Potassium and Sodium Bromide Solutions," *Journal* Am. Chemical Soc., Vol. 55, p. 4496 (1933); "International Critical Tables," Vol. 6, p. 152, McGraw-Hill Book Co., New York City (1929).

[18] J. O. Burton, available at the Library of the University of Maryland, College Park, Md.

ties, and other related properties which are necessary to interpret pH data.

Indicator Standards:

Precision measurements should be made by suitable methods of (*a*) the ionization constants (pH ranges) and (*b*) salt errors of highly purified indicators to establish fundamental indicator standards of several chosen concentrations and adjusted in 0.2 pH steps from pH 0 to pH 14 at 0 C. to the highest temperatures toward 374 C. at which the indicators remain undecomposed. Such fundamental standards should be kept constantly on hand.

Buffer Standards:

Precision measurements should be made of the ionization constants (pH ranges) and salt errors of a series of highly purified buffer materials by various pH methods to give fundamental pH standards in 0.2 pH steps from pH 0 to pH 14, and in concentrations from 0.001 to 1 *M*, or higher and at 0 to 374 C. Such a precision study should include work on the carbonate and phosphate buffers and their reaction products, which would give information of value, because of their importance in the case of raw, treated, and boiler waters. Several pure solid buffers should be similarly calibrated for making up standard solutions for use as reference pH points for checking electromotive force and colorimetric apparatus. Such fundamental pH standards should be kept constantly on hand.

Oxidation-Reduction Standards:

Additional pure oxidation-reduction indicators should be synthesized to establish a complete series; the electrometric and colorimetric fundamental standards should be prepared therefrom and related to the fundamental pH standards with consideration of salt errors.

Electrokinetic Studies:

Electrokinetic standards and precision equipment should be developed. For example, precision studies should be made at 0 to 374 C. on the effects of associated ions and organic materials on the electrokinetic properties (especially mobilities and isoelectric points) of precipitates of importance.

Standards in Organic Solvents:

Besides standards in aqueous solutions, similar standards should be developed for the various classes of organic liquids.

Educational Program:

Research associates of various institutions, national organizations and the staff of the National Bureau of Standards might in addition cooperate in preparing and disseminating research articles; special circulars covering the best use of present test methods, apparatus, and processes, and outstanding new developments along these lines; editorials on pH progress in different fields; and full abstracts of all pH and related literature.

Institute of Ceramic Engineers Being Formed

THERE is now in process of formation a new Institute of Ceramic Engineers of the American Ceramic Society and late in February it will start receiving applications for membership from all ceramic engineers desiring to join.

During the past several years various states began to license engineers, and the Engineers' Council for Professional Development started to accredit various engineering schools. In these movements, the ceramic engineer was considered only to a very limited extent. To meet the situation and bring recognition to the ceramic engineer, Keramos (the honorary ceramic engineering fraternity) through the activities of Prof. A. F. Greaves-Walker, North Carolina State College, petitioned the Board of Trustees of the American Ceramic Society for permission to form an organization of ceramic engineers within the Society. This request was granted and the Constitution was amended to provide for the new Institute.

Membership and Rules Committees have been named and a Nominating Committee will select candidates for the election of officers of the Institute during 1938.

The Institute of Ceramic Engineers will be somewhat different from some of the other engineering societies, in that there will not be any grade of membership open to those with only an interest in ceramic engineering. The entire membership will consist of ceramic engineers and other engineers engaged in ceramic engineering work.

The first meeting of the Institute is to be held during the annual meeting of the American Ceramic Society in New Orleans, March 27 to April 2, 1938.

UNIQUE INTEREST COLUMN

Editor's Note.—Material for this column will be welcomed from any of the members and those who may have information in their files or know of sources where appropriate items can be obtained are urged to send them to Society Headquarters. It is planned that the items used will relate to the materials field, but they may not necessarily refer specifically to standardization or testing. The column will be essentially a members' column.

Collection of aluminum "whatsits" picked up in an aluminum foundry. The shapes are "as-spilled," the art work is "ad lib."

(Courtesy of *The Iron Age*, represented in A.S.T.M. by T. W. Lippert.)

LETTER TO THE EDITOR

A.S.T.M. in Basic Research?

A QUESTION often discussed when A.S.T.M. men get together is: "Should our Society be particularly interested in fundamental research?" The industrial laboratory has been regarded, perhaps rightly so, as an adjunct to the shop—a tool to be used when something goes wrong with production. Is this necessarily its sole function? There are organizations that recognize a broader scope but unfortunately there are not many, and even in these it too often happens that the value of basic research is judged in terms of probable manufacturing profits in the not too remote future. It must be regarded that, for the most part, industry confines its laboratory activities to present necessities and to those of the very immediate future.

It is not hard to see why this should be so. Manufacture is the dominating interest and management is production conscious. The executives in charge have achieved their positions because of exceptional sales ability or because of other production achievement (there are some exceptions). They appreciate the laboratory as an adjunct to production.

The industrial laboratory *should* be organized to handle current problems of manufacture. *But* industry should be interested, too, in more far-sighted investigation. Basic research has no real place in the atmosphere of production. It views the more remote future. It is a long-time investment, and a sound one. It does not offer immediate profit. It is, or should be, concerned with manufacture 5, 10, or perhaps 20 years hence. It is the life insurance of the company, though a peculiar kind of life insurance, since it actually insures that the insured will continue to live. The usual kind pays damages to the beneficiaries after the death of the insured.

The value of Fundamental Research is being recognized more and more by industry—maybe as a headache as far as immediate investment is concerned—but as a necessity if the enterprise will continue to exist. There are some, even now, who subsidize scientists and let them alone to work out scientific problems in corners shielded as much as possible from the ordered confusion of the tense activity of manufacture, and there are a few who have placed men of high scientific achievement in elevated positions of authority.

Production minded executives cannot, except in broad outline, tell scientists what to work on and not at all how to work. No one knows what will be the developments of tomorrow. It is a safe bet, however, to study and to learn all that can be learned of the basic factors that must be involved in those developments. New structural materials must still be made from the elements listed in the periodic chart of the atoms. They must perform according to the laws of nature, whatever peculiar circumstances may condition their applications. If money is invested in acquiring knowledge of fundamental factors, it cannot be regarded as entirely lost. Viewed in this way, basic research is a safe investment and will pay dividends, possibly large ones.

The problem is illustrated in our national defense. Time was when wars were fought with armies. Now the army is the spearhead, the force of the blow is delivered by the coordinated economic resources of the nation. The War Department is very much concerned with the immediate production of its devices and its laboratories must serve this interest. However, it must look ahead, and who knows what scientific principles or what kinds of scientific developments will be used in future engines of offense or defense? It does know that any new device will involve fundamental laws of some kind.

The interest is broader than the limits of the regularly constituted organization, whether it be an army or a lamp factory. In the case of the army, the whole economic system of the nation really becomes its interest and all of science becomes its science. In the case of the lamp factory, the breadth of organization is narrower and so is its scientific interest, but it still includes very pointed inquiry into the fundamental science involved in illumination.

Fundamental information is not ordinarily patentable. Researches of a basic nature can be carried out best if the resources of a whole industry are behind it. It is a matter for cooperative effort, which brings in the industrial society.

The question arises, can this cooperative effort be accomplished best through A.S.T.M. or through other societies? There is ground for argument. A.S.T.M. is a society through which industrial organizations have been in the habit of acting on questions that pertain to general technical interest. It would be natural for them to look to A.S.T.M. for research coordination and guidance. On the other hand, other societies have specialized to some extent in basic research and have the personnel.

Whether or not A.S.T.M. does turn more heavily toward basic research, it must be interested in it, because it will be regarded more and more as industrial and may lose much of its academic aura. It would seem that the time is ripe to consider seriously the place of A.S.T.M. in basic research.

The opinions of other members would be of interest to many of us.

H. H. LESTER

Watertown Arsenal
December 2, 1937

EDITOR'S NOTE.—In the accompanying Letter to the Editor, Doctor Lester raises an interesting and rather far-reaching question—one that undoubtedly will assume greater importance as time goes on. While much of the Society's research is best described as "applied" rather than "fundamental," there are some instances where committee investigations come very close to fundamental research—the studies of the Joint Research Committee on Effect of Temperature on the Properties of Metals and those of Committee E-4 dealing with Radiography and X-ray Diffraction are cases in point; and quite often a committee study develops the need for information of a fundamental nature. As Doctor Lester has said, we must be interested in basic research. The question is, to just what extent should our interest lead us into actual research of this type?

These columns are open to a discussion of this question by our members.

ASTM BULLETIN

Published by

AMERICAN SOCIETY FOR TESTING MATERIALS

No. 90 January, 1938

Standards and Progress

WHEN the relation of standardization work to progress in the materials field or other fields is discussed, we always think of the article which Professor Meyenberg wrote for the journal *The Metal Industry*, London, and two paragraphs from that article especially impress us.

"Standards are the foundations on which we stand, working for progress; but we make this progress only when we are sure that the new ideas and inventions bring common advantages, never forgetting that 'Better is the enemy of good.' Therefore it is clear that standards are not sterile creations as is sometimes said of them. They pave the way for progress, giving the best that is known at the moment to the whole of mankind without any restraint; preventing continuous change but at the same time promoting steady evolution.

"Another important mark of a standard is that it is not the work of a single person but the result of enlightened cooperation. A number of people become dissatisfied with the lack of uniformity in some product or process; they wish to avoid uncertainty and demand a compromise between conflicting interests and the elimination of struggles which expend energy which could be better employed for other purposes. Therefore standards are an embodiment of the great idea of cooperation which is the foundation of modern society. Without standards our state, our commerce, and our traffic would be inconceivable."

We recently had the privilege of viewing an important part of one of the pieces of equipment used in electrical communication that is now being die cast, with tremendous increase in production and with important refinements. This remarkable achievement in the words of one who took a leading part in its development was not possible until the Society's Committee B-6 on Die-Cast Metals and Alloys had made important progress in its studies of die-casting alloys and established certain specification requirements.

One of the committee officers in submitting a brief statement of the accomplishments and future work of Committee B-4 on Electrical-Heating, Electrical-Resistance and Electric-Furnace Alloys makes this pertinent statement: "The general adoption of the life test method has resulted in such an improvement in the life of alloys used in electrical heating that it has been necessary to increase the temperature of test in order to bring the duration of the test within a reasonable length of time."

We believe strongly that these two examples and many others which could be recited amply justify Professor Meyenberg's statement—"they pave the way for progress."

Commended for Attention

THE paper on "Some Fundamentals in Standardization" by Dr. Frank B. Jewett, reprinted in this issue, is one of the most interesting and informative discussions of the subject that we have ever read. The author, speaking from a background of over thirty years' experience in the development of electrical communication with the Bell Telephone system, has brought into sharp relief such matters as the need for continuous critical surveillance of standards, lest they become hindrances instead of aids to industrial progress; the importance of determining just when conditions are ripe for the development of specific standards; and the value of trial use of proposed standards before final adoption.

He develops most effectively the thesis that, in general, industrial standards are best developed by broad voluntary associations, democratic in their make-up and methods of procedure, letting facts rather than opinions guide their actions, and finally, having no police powers of enforcement but depending, in Dr. Jewett's words, "on the proven validity of their conclusions and the recognized standing of their members [to] insure general acceptance of their work."

While the paper discusses standardization broadly, our readers will see in it many pertinent applications to the work of our own Society in the materials field. We commend it to the attention of those hundreds of our members who are actively engaged in A.S.T.M. standardization work.

Research Laboratories

THERE are over 1600 industrial research laboratories in the United States. This number does not include federal, state, or municipal government laboratories or the 186 college laboratories which are conducted not only for instructional purposes but also, to a considerable extent, for research work. This number is astounding. It shows the widespread interest in research and the extent to which industry depends upon the findings of these laboratories for the improvement in their existing products and the development of new products.

Many of these industrial research laboratories are small, although of prime importance to the companies they serve. Others are large; one employs approximately 3000 research physicists, chemists, and engineers, and others immediately concerned with technical activities.

Two of our foremost Federal laboratories are the National Bureau of Standards and the U. S. Bureau of Mines. The former carries on work relating to the standardization of test methods and test equipment and also engages in a large variety of general fundamental research. The latter engages in work for the mining industry and its correlated by-products. Both of these laboratories are doing excellent work and should be amply supported by the Government.

Many of our college laboratories are doing excellent work

in the field of fundamental and industrial research. In fact, much of the industrial activity goes back to the fundamental work which is done in these laboratories.

Of the 1600 odd industrial laboratories in the country, approximately 270 are listed as commercial testing laboratories. Although in years past many of these have engaged almost exclusively in commercial testing, there has been a trend in recent years for many of the better and larger ones to engage in research work of an applied type and in certain instances to carry on work of a fundamental nature.

Two of the research laboratories, namely, Mellon Institute and Battelle Memorial Institute, have refrained from work of a testing character and have engaged primarily in research work of an applied or fundamental nature.

One cannot review the work that is being done in these various laboratories without appreciating the extent to which industry leans upon their findings for its further progress. Likewise, it is through work done at these laboratories that it is possible for organizations such as our own Society to carry forward their work in developing standard test procedures and standard specifications for the vast number of materials used in commerce and industry.

President

Specifications and Toy Trains

An article in this BULLETIN discussing the use of A.S.A. standard B 36.10 covering wrought-iron and wrought-steel pipe reminds us that specifications are somewhat in the class of toy trains—one can spend hours during the holiday season preparing a platform, erecting figures and hooking the train up electrically, but if the train is not operated, we would consider most of the effort misplaced. Likewise with standards—a great amount of time, money and effort can go into the drafting of a standard specification or test, but dividends from the investment will come only if the specification comes into definite use.

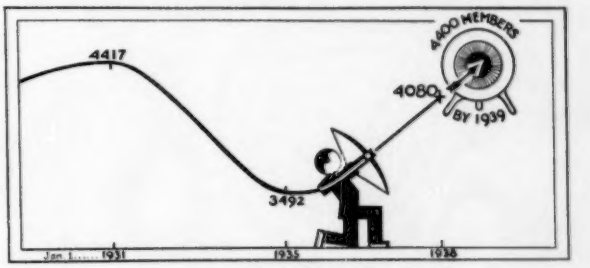
The increasing use of A.S.T.M. standards has been especially noticeable during the past year. This is significant. All members can help in the standards work by taking such appropriate steps as they can to insure practical use of the specifications and tests—not only from the standpoint of products manufactured, but in connection with materials which are purchased.

Schedule of Meetings

DATE	COMMITTEE	PLACE
January 24, 25	Executive Committee	Philadelphia
February 28, March 1	Committee D-9 on Electrical Insulating Materials	Philadelphia
March 9 to 11	D-13 on Textile Materials	Washington, D. C.
March	D-7 on Timber	Chicago, Ill.
March 7-11	COMMITTEE WEEK	Rochester, N. Y.
March 9	REGIONAL MEETING	Rochester, N. Y.
June 27 to July 1	ANNUAL MEETING	Atlantic City, N. J.

Substantial Gain in Membership

With 441 new members elected in 1937, and losses of 180 from death, resignation and delinquency, we record a net growth of 261—the largest in ten years—bringing the membership as of January 1, 1938 to 4080. The number of new members is very gratifying—nearly one-fourth can be directly attributed to the expansion of the Society's work into such new fields as glass, paper and plastics. It is the best record since 1926, and is a tribute to the interest and efforts of many of our members to regain the "pre-depression" membership level.



"With Every Member Pulling"

Our goal is 4400 members by 1939. We need to better 1937 records quite a little to reach it, but with "Every Member Pulling" and the continued interest and support of our District and Standing Committees, it can be done.

Here is a thought for each member to keep in mind. On the one hand, the value of an A.S.T.M. membership is admittedly high, and it increases with each year; on the other hand, new men are coming continuously into our field of materials who can benefit greatly from such membership, and who do not know much about us. Just get the man and the idea of membership properly together; mix thoroughly in the presence of a catalyst—such as an opportune word on what A.S.T.M. membership has meant to YOU—and the "end point" is pretty sure to be a new member.

Headquarters Office Space Expanded

Because of a need for increased office space at Society Headquarters, the Executive Committee has recently authorized the lease of another room adjoining the present offices at 260 S. Broad St. This increases the space by about 20 per cent and enables certain rearrangements to be made including provision for a new proofreading and conference room. This is also available for committee meetings and together with the Board Room and certain other space will enable several small committee meetings to run simultaneously.

Increased space was needed because of certain additions to the Headquarters personnel which in turn were occasioned by the marked increase in the amount of work incident to the greater standardization, committee and other activities.

Members who may have the opportunity for so doing are cordially invited, in fact, urged to visit the Headquarters Offices. Any of the members who may wish to make use of the Members' Lounge, telephone facilities, etc., are welcome to do so.

DISTRICT COMMITTEE NOTES

Detergency Subject of New York Meeting

At a meeting on December 2, of about 125 members of the Society and guests in the New York District, Dr. Foster Dee Snell, well known consulting chemist and chemical engineer gave an interesting lantern slide talk on the subject, "Some Factors in Detergency." This meeting, sponsored by the New York District Committee, was held in the auditorium furnished through the courtesy of the Consolidated Edison Co., at Irving Place and E. 14th St.

Dr. M. F. Skinker, chairman of the District Committee, introduced President White, who greeted the members and guests on behalf of the Executive Committee. He pointed out the youthfulness of many in the audience who were destined to carry on the activities of the Society in the future. The progress made by the Society was mentioned and he pointed out the importance of the widespread distribution of the various publications, the income from which has been important in expanding the various phases of A.S.T.M. work. The importance of specifications was discussed and some details of developing them mentioned.

B. S. Van Zile, Chemist, Colgate-Palmolive-Peet Co., secretary of Committee D-12 on Soaps and Detergents next spoke, explaining the origin of this committee which was formally organized in 1936. He mentioned that several specifications and test methods covering materials in the scope of the committee had been developed and published. He pointed out that because of the involved nature of the work confronting the committee, an active program was under way.

Doctor Snell was then introduced by Doctor Skinker. In his talk he covered the theories and practices involved in the cleaning of fabrics, metals, dishes and paints. Lantern slides showed data and graphs pertaining to acidity and alkalinity of materials to be cleaned, detergents, soaps, and alkali builders. He pointed out that the removal of soil from textiles, dishes, metal, the skin and other surfaces depends on the same factors, with minor differences in their quantitative evaluation. Most detergents, including soap, are alkaline and the pH of the solution has an important bearing on their effectiveness. The total alkalinity or buffer action of alkaline detergents is important because nearly all soils are acid and therefore neutralize some of the alkalinity. Whether alkaline or not, unless the detergent operates by purely mechanical action, it lowers the interfacial tension between the solvent, usually water, and the soil. This results in efficient wetting of the soil by the detergent solution and therefore normally in loosening the soil from the surface to which it is attached.

Formation of "nascent" soap at the interface by reaction between an alkaline detergent and an acid soil is an important factor. The presence on the surface of soil of fatty and oily materials even though in only a layer a few molecules thick, causes the properties of the soil to be inherently those of a liquid rather than those of a solid. The first step in detergency is therefore the loosening of the soil from the surface to which it is attached and the next step is its dispersion in the solvent so that it can be carried away. The latter property is a combination of deflocculating and emulsifying power which while distinctly different in terms of physical chemistry, are measurable only in terms of their aggregate.

While explained in terms of detergency of soap and alkaline salt mixtures as applied to textile fabrics this was then related to metal cleaning, wetting out of textiles and many other detergent operations. The application of these factors is not related to any one form of detergent since some or all of them apply to such diverse types of detergents as dry cleaning soaps, the alkyl sulfates and related compounds, sulfated oils, etc.

Joint A.I.M.E.-A.S.T.M. Chicago Meeting

Chicago members of the Society joined with the local members of the American Institute of Mining and Metallurgical Engineers in a meeting on December 8 at the Chicago Engineers' Club, which was addressed by Dr. W. Augustine, a member of the Resident Medical Staff of the City Contagious Diseases Hospital; and by Dr. A. C. Fieldner, Chief, Technologic Branch, U. S. Bureau of Mines. Preceding the meeting there was a dinner at which 72 were present. George Birkenstein, Chairman of the Chicago Section of the A.I.M.E. presided.

Dr. Fieldner, Past President of the Society, was introduced by D. L. Colwell, Technical Chairman, A.I.M.E., and spoke on the subject, "Fuels of Today and Tomorrow." In his talk he discussed the production and utilization of fuels for the past thirty years, covering, in the order mentioned, the Rise of Petroleum, Displacement of Coal by Fuel Oil, the Rise of Natural Gas, Coal Production and Utilization, Carbonization and Gasification of Coal, Present Day Fuel Supply and Demand, and Fuels of Tomorrow. The subject matter covered was the same as that given in his address as retiring President at the A.S.T.M. Fortieth Annual Meeting in New York City.

The address was very enthusiastically received and Dr. Fieldner answered many questions presented by those in attendance at the meeting.

Sand and Gravel Research Foundation

The National Sand and Gravel Association has made an arrangement with the College of Engineering of the University of Maryland for the conduct of research at the University. Testing equipment which is now in the laboratory of the Association in the Munsey Building, Washington, D. C., will be removed to the University at College Park, Maryland, only a few miles from Washington. The research work started by the Association when its laboratory was established in 1928 will be continued at the University. The new arrangement provides for the National Sand and Gravel Association Research Foundation, which will be operated by the Association with its activities subject to the approval of a joint advisory committee on which the University and the Association will have equal representation. Stanton Walker, Director of Engineering of the Association, will be a member of the joint advisory committee and the work of the Foundation will be directed by him.

Committee on Laboratory Glassware Changes Set-Up

As a result of a recommendation made at its June meeting and subsequently confirmed by letter ballot, the status of Committee D-15 on Thermometers and Laboratory Glassware has been changed from that of a Society standing committee to a technical committee of Committee E-1 on Methods of Testing. The recommendation of Committee D-15 was approved by the Executive Committee. It was felt that because its work was very largely devoted to the preparation of specifications for glassware and thermometers for use by other A.S.T.M. standing committees, the inter-committee activities could be handled more efficiently under Committee E-1 since one of the principal functions of this administrative committee is to aid and advise the Society's standing committees in matters relating to standard methods and instruments of testing. The committee felt, too, that as a technical committee its membership could be more readily expanded to take care of special problems concerning apparatus which might arise in the other Society committees. There was a feeling also that in view of the general supervisory character the work should fall in the group of "E" committees, rather than in the "D" group.

The present officers, W. H. Fulweiler, Consulting Chemist, Philadelphia, Chairman; E. N. Hurlburt, Sales Engineer, Taylor Instrument Cos., Vice-Chairman, and J. M. Roberts, Secretary and Treasurer, Scientific Apparatus Makers of America, Secretary, will continue as the officers of this new technical committee of Committee E-1.

The detailed work of the new technical committee will be assigned to four sections now being organized, as follows: I, on Thermometers; II, on Hydrometers; III, on Volumetric Glassware; and IV, on Laboratory Glassware.

The personnel of the former Committee D-15 will be the nucleus membership of the new technical committee. This personnel includes representatives of the apparatus manufacturers and of the users and those having a general interest in laboratory glassware. In addition, the membership of the committee includes representatives from the interested standing committees.

The new committee will be in an excellent position to advise the standing committees on problems of design of glass apparatus that may arise from time to time in their standardization work. Through the representatives from the standing committees the new committee will be kept currently advised of any new specifications or methods in preparation by the committees which contain requirements for any type of glass apparatus. This will make it possible for the standing committees to obtain the advice of the manufacturers before the proposed standard is issued by the Society. In this way the committee will be in a position to improve or correct the design of any new glass apparatus before such apparatus has been definitely established. Such activity on the part of the new committee should be of considerable value to Society committees and will result in increasing the accuracy of the apparatus, provide more reasonable or proper tolerances and result in specifications for apparatus in terms that will avoid misunderstanding or misinterpretation by the manufacturers.

J. A. Capp Dies Suddenly

Members of the Society will be shocked to learn of the sudden death of John A. Capp, Engineer of Materials, General Electric Co., Schenectady, N. Y. Mr. Capp had gone to the hospital on January 3 for an appendectomy and though his condition at first was satisfactory complications developed which resulted in his death two days later.

A member of the Society since 1898, his contributions to the work of A.S.T.M. are many. He has been a member of a great many committees, either in a personal capacity or representing his company and he has served as chairman of a number of them. A past president of the Society, he was awarded an honorary membership at the 1937 Annual Meeting in New York City, as a fitting recognition of his very valuable accomplishments for A.S.T.M.

News of his death is received just as this BULLETIN goes to press. Further mention of his many contributions will appear in the next BULLETIN.

Super-Purity Metals

In a short article on the work of Committee E-2 on Spectrographic Analysis in another portion of this BULLETIN information is given concerning activities on super-purity metals which are so important in the field of quantitative spectrographic analysis. Information on an additional material was received too late to include in the report and because of its importance, is given here for the information of members and others interested. The information follows:

GRAPHITE—SUPER-PURE

Producer:	The Dow Chemical Co.
Form:	Standard spectroscopic rods.
Cost and Availability:	Not yet determined.
Analysis:	Highest purity graphite available. Spectrographic tests show practically no trace of any impurity element except boron.

Meeting of Committee C-4

At a meeting held in Chicago on November 17, Committee C-4 on Clay Pipe elected Prof. Anson Marston of Iowa State College to serve as chairman in place of G. T. Hammond, the former chairman, who died some time ago. To succeed Professor Marston who previously held the office of vice-chairman of the committee, J. C. Riedel, Deputy Chief Engineer, Board of Estimate and Apportionment, City of New York, was chosen. R. G. Scott, Clay Products Association continues as secretary of the committee. D. G. Miller, Senior Drainage Engineer, Bureau of Agricultural Engineering, U. S. Department of Engineering, was appointed a member of the Advisory Committee.

There was an interesting and informal discussion at the meeting of a number of problems of interest to the work of the committee, particularly with reference to crushing test and jointing of pipe. The possibility of developing certain informative data through research work was considered. One of the problems discussed was the question of tests of jointing compounds with the object of finding material that would eliminate excessive infiltration.

Why Not Use the ASA-B36.10 Standard in Ordering Pipe? Advantages to Consumers and to Producers

As an outcome of the creation some ten years ago of a Sectional Committee, sponsored jointly by the A.S.M.E. and A.S.T.M. under the procedure of the American Standards Association, for standardizing the dimensions and material specifications of pipe and tubing, Tentative American Standard B36.10 for Wrought Iron and Wrought Steel Pipe was published in 1935. Following this interval of probation, the tentative standard is now being considered for advancement to full standard.

The aims of the committee in developing the standard were as follows: (1) to establish rational schedules of thickness based on ratios of pressure divided by stress; (2) to include thicknesses suitable for welding; (3) to provide suitable thicknesses in anticipation of development of new processes and materials for manufacturing and erecting piping; (4) to eliminate unnecessary duplication by reducing the large number of intermediate weights of pipe to a few commercially practicable schedules of thickness; (5) to codify the various materials specifications suitable for manufacturing pipe and to arrange the formulation of additional specifications where required. Although the committee has produced a carefully considered standard in accordance with these aims, its commercial acceptance has not been as rapid as is desired.

Rational schedules of thickness have been set up with reference to a constant ratio of fluid pressure to bursting stress throughout the entire size range in order to make feasible selection of wall thicknesses from the same schedule for all pipe diameters for any one pressure service, such as main steam piping, for instance. This is a decided simplification from former practice since it was necessary to select from several weights of pipe if reasonably uniform working stresses were to be obtained throughout the range of diameters needed. Now better conformance is assured between plant conditions and pipe wall thickness as contained in the schedule thicknesses of the new standard.

Lighter wall schedules than the old "standard weight" have been provided for economy in welded construction where the pipe is not weakened by threading. Rapidly increasing erection of pipe in the field by welding has enabled selection of thinner wall pipe than was formerly available in "standard weight." More of the lighter weight pipe would be called for now if it were available from jobber's stock. At the present time, it is impossible to secure these thicknesses from local jobbers with the result that Schedule 40 is often ordered when a lighter weight pipe would serve to better advantage.

Selection of wall thicknesses in accordance with the standard has been confined largely to high-pressure high-temperature piping in central stations where the schedules have been found particularly helpful in providing standard thicknesses in alloy material. In an effort to avoid specifying a large number of different wall thicknesses to suit individual pressure-temperature conditions, the pipe manufacturers and the Prime Movers Committee of the Edison Electric Institute agreed to give preference to certain sizes and schedule thicknesses of the new American Standard in ordering and stocking carbon-molybdenum pipe for central stations.

The economic reasons for this standardization, namely, to facilitate delivery, particularly on replacement orders, and to avoid a costly mill set-up for producing a small quantity of pipe, will aid in the more widespread acceptance of this standard in the alloy field as the only means of avoiding a hopeless complexity of special wall thicknesses with attendant high production costs.

The primary purpose of the standard is to reduce the large number of odd weights of pipe to a few standard commercial schedules of thickness which will simplify the stocking problem to the extent that nearly any of the schedule thicknesses can be secured from jobber's stocks. This aim has not been realized as yet due to the unwillingness of the piping trade to abandon the obsolete terminology of "standard weight," and "extra strong" as such, although most of these thicknesses actually are included in the new Schedules 40 and 80.

The oil industry has been reluctant about adopting the B36 standard through fear that it would curtail the possibility of obtaining odd thickness of pipe on special order from the mill. While this possibility is important where several miles of pipe are under consideration for a particular job as frequently is the case for cross country gas and oil lines, there was no intention of urging too rigorous compliance with the standard, and manufacturers will, no doubt, continue willing to make a special rolling where economical to do so. For small quantities of pipe as in refineries, however, it would seem more profitable in the long run to accept a standard thickness slightly over the minimum computed value, since the lower cost of production with the standard thickness schedules in effect will eventually be reflected in a lower cost to the consumer. It is hoped that the oil industry will come to accept this viewpoint.

Lack of full cooperation between pipe manufacturers and consumers in adopting the new standard is penalizing both interests. Because of the obvious advantages to be derived by all, there should be an increasing tendency to order pipe for ordinary purposes in conformance with the schedule thicknesses, thus ultimately effecting satisfactory acceptance of the standard by the entire pipe trade. However, due regard should be given the need for filling large mill orders with special thickness pipe if and when required.

It is urged that all pipe producers endeavor through their sales literature and contacts to fix the concepts of the new standard with their customers as the basis of purchase. At the same time the trade associations representing consumer interests can well give the matter publicity through their literature. It will be only through an active effort to acquaint more fully the piping trade with the aims of the standard that it will be possible to extend its use to a point where real benefit will accrue.

That its widespread adoption will be of distinct value cannot be questioned.

(Note.—Copies of this standard can be obtained at 50 cents each from the headquarters' offices of the sponsor societies or from the A.S.A. office.)

A proper engineering or industrial standard is a common meeting place for purchaser and seller with no signs of caveat emptor *about.*
—Jewett.

Impact Symposium at Annual Meeting

ONE of the outstanding technical features of the 1938 (Forty-first) Annual Meeting to be held in Atlantic City, June 27 to July 1, is to be a Symposium on Impact Testing. Details of the symposium which promises to be an extensive one are being developed by W. W. Werring, Bell Telephone Laboratories, Inc., Chairman of the Section on Impact Testing, Committee E-1, and by M. S. Sayre, Professor of Applied Mechanics, Union College. Professor Sayre is representing other interests than A.S.T.M. who are actively interested.

Preliminary ground work for the symposium was laid at a round-table discussion held during the 1937 Annual Meeting in New York. At that time, there was expressed a need for a symposium to correlate the great amount of data which have been developed over a period of years and also to provide an opportunity for leading authorities to discuss the many angles involved in impact testing. The tentative outline provides for a number of technical papers. These will be grouped under the following general headings:

A. The Basic Theory Underlying Impact Tests.
B. Velocity of Loading as a Factor in Strength and Resilience.
C. Temperature as a Factor in Strength and Resilience.
D. Notch Concentration Effects as a Factor in Tension, Fatigue and Impact Values.
E. Present-Day Uses of Impact Testing.

Further details of this symposium will be announced as developments occur.

There will be a large number of other technical papers and committee reports—the program for the meeting as a whole being developed by Committee E-6 on Papers and Publications.

British Corrosion Specimens Installed

THERE have recently been installed at three of the Society test locations nine ingot iron panels furnished by the Corrosion Committee of the British Iron and Steel Institute, this committee having requested the cooperation of the Society in installing the specimens, which are 4 by 2 by $\frac{1}{8}$ in. in size, and reporting on their inspection. Other countries are cooperating in the test work. Certain work necessary to prepare the panels for installation was done by the National Bureau of Standards.

Panels of sheet zinc were also exposed at the same time as the ingot iron material, these panels having been furnished through the courtesy of the New Jersey Zinc Co. The three test locations, at which panels are exposed, are as follows:

1. Fort Hancock, Sandy Hook, N. J., close to the Atlantic Ocean, giving a sea air exposure. Specimens exposed October 22, 1937.
2. Pennsylvania State College farm, State College, Pa., a rural location, far from any industries and with very pure air. Specimens exposed October 19, 1937.
3. Bruno Island, Pittsburgh, Pa., an industrial location with considerable smoke. The smoke comes from sources sufficiently removed so that it is uniformly diffused in the air surrounding the test field. Specimens exposed October 18, 1937.

Certain details concerning the inspection data desired by the British Committee are being developed.

Metallographic Polishing Cloth Available

REALIZING the difficulty members of the Society have in securing "kittens-ear" broadcloth for use in metallographic polishing, Subcommittee I on Selection and Preparation of Committee E-4 on Metallography has for some time sought a suitable substitute. A very satisfactory material can be secured, but must be purchased in bolts 50 yd. in length and 53 in. wide.

A composite order for at least one bolt is now being assembled and any member of the Society is being invited, by means of this notice, to join the subscribing group. For convenience, it is requested that orders specify the desired lineal yards of full-width material. Based on the latest quotation, the price of the material will be about $5.50 per yard, although the cost *may* be slightly higher.

It is requested that members interested in securing some of this material advise E. H. Dix, Jr., Chairman of Subcommittee I, P. O. Box 772, New Kensington, Pa., of their requirements. Formal purchase orders need not be issued at this time, nor need money be sent until further notice.

Extra Copies of Widely Used Index to Standards Available to Members

DURING the latter part of January, each member will receive a copy of the Index to A.S.T.M. Standards and Tentative Standards, as of January 1, 1938. A number of the members have "standing orders" for extra copies of the Index—for distribution to their associates and for use in other ways. Any members of the Society can get extra copies of this widely used publication by writing to Society Headquarters. No charge is made for the publication. The 1938 Index will comprise some 120 pages, in heavy paper cover.

With a marked increase each year in the number of A.S.T.M. specifications and tests, the annual Index becomes of greater utility and it is being used more and more widely. Each year many additional requests are received for copies.

The Index gives under appropriate key-words the titles of all A.S.T.M. standards and tentative standards, together with page references to the current Society publications in which they may be found. Each standard is carefully cross-indexed under the principal subjects it covers. The Index is of particular value for two reasons: First, it enables a particular item to be quickly located in the publication; second, it provides a quick reference for anyone who wishes to determine whether or not there is an A.S.T.M. specification, test, definition, etc., on a particular subject or material

The latest Index will provide an alphabetical listing of the main items covered by the standards and also a complete list of A.S.T.M. designations in numeric sequence. This latter is of assistance in determining the subject matter and publication references of a standard when only the designation is known. It also includes a list of committees and officers of the Society and information on various publications.

Many members place the Index next to the Book of A.S.T.M. Standards so that it is readily available.

Symposium on Coal Tests

THE Symposium on Significance of Tests of Coal comprising six extensive technical papers and discussion presented at the Fortieth Annual Meeting in New York City has been issued in the form of a special publication; it is also being published in the 1937 *Proceedings*. Because of the widespread interest in the subject, it is believed many will wish to have copies of the symposium in separate form. The symposium, sponsored by Committee D-5 on Coal and Coke, was developed by a special Symposium Committee comprising the following: A. W. Gauger, *Chairman,* Director, Mineral Industries Research, Pennsylvania State College; G. B. Gould, President, Fuel Engineering Co.; J. B. Morrow, Preparation Manager, Pittsburgh Coal Co.; and Alden H. Emery, Engineer, A. H. Emery Co.

The papers and discussion cover such factors as significance of ash softening temperature and ash composition, interpretation of laboratory tests-proximate analysis and calorific value, significance to the consumer of sulfur, laboratory tests on caking and related properties of bituminous coals, the significance of friability and size stability test, and pulverizer performance. The Symposium Committee has pointed out that coal is a complex mixture of organic and inorganic materials, the chemical identity of only a few of the compounds being known. Many test methods have been proposed and tried through the years and while some of these have become standardized most of them are imperical and do not as a rule measure properties but rather the behavior under fixed conditions. Interpretation which is of utmost importance in all experimentation is vital in the case of tests used in fuel technology.

The symposium provided an opportunity to a group of men of wide experience to exchange ideas and discuss in detail the meaning of results of coal tests. In its published form it includes the ideas and experiences of leading technologists. The Symposium Committee is hopeful that the pamphlet will stimulate further study and discussion in this field.

The publication should be of widespread interest to all who are concerned with the production and use of coal. Members can obtain copies of this 125-page publication at the special price of 75 cents; the list price is $1.00.

Die Castings Report Printed

THE 1937 report of Committee B-6 on Die-Cast Metals and Alloys has been printed in separate form in advance of its inclusion in the 1937 *Proceedings*. In addition to discussion of the work of the committee, the report is of special interest this year because it includes two important technical papers, one on "Brass Die Castings" by J. C. Fox, Doehler Die Casting Co., and another on "A Study of Die Design Changes for the Improvement of the Soundness and Uniformity of Test Bars" by G. L. Werley, New Jersey Zinc Co. The first-named paper discusses important factors in connection with the production and use of die castings of copper-base alloys. It covers such factors as dies, alloys, alloying practice and economic position of brass die castings. The paper on die design study discusses work done to reduce the number of specimens required to be averaged to obtain significant results for routine tests and also similar improvements in the A.S.T.M. die so that producers cooperating in the production of test bars can alter their dies to attain an improvement in uniformity and soundness. Copies of this reprint, 45 pages, can be obtained by members at 50 cents per copy; the list price to non-members is 65 cents.

Wire Inspection Committee Doings

THE agricultural engineers, who are in charge of the wire corrosion test exposure plots at the university sites, assembled at Purdue University, Lafayette, Ind., on December 3 where they met with another group of the Wire Inspection Committee. The purpose of the meeting was to give some of the veteran members of Committee A-5 a chance to meet their new associates, and to promote a better understanding of the wire inspection job. Almost ten miles of test samples involving farm-field fencing, barbed wire, unfabricated wire, wire strand and chain link fence are on exposure in this extensive investigation.

The Society needs the intelligent cooperation of these agricultural men who reside near the university test sites. These sites are distributed from Cornell to California, and consequently it is impracticable to have the specimens inspected twice or even once a year by the travelling committee method. The university men understand this and also appreciate the need for self training so that they will inspect specimens in a manner similar to other Committee A-5 inspectors and make comparable reports.

C. L. Warwick, Secretary-Treasurer, who is director of the tests, helped to promote understanding at the Purdue meeting by giving a short talk on the general methods followed by A-5 in its exposure test projects, and on the planning, financing, and potential engineering value of the wire exposure tests. Following this, there was an explanation by C. D. Hocker, Bell Telephone Laboratories, Inc., Chairman of Committee A-5's Wire Inspection Committee, of the different corrosion stages through which zinc coatings pass and why different kinds of such coatings behave differently in the progress of their corrosion, illustrated by exhibits of corrosion specimens and micrographs. Some time was then given over to inspecting corroded specimens and comparing observations to achieve better correspondence of judgment. Later in the afternoon there was a visit to the test plot located on the University property at Purdue.

Prof. B. A. Jennings of Cornell University arranged that the Purdue meeting be held on December 3—the day after the close of a convention in Chicago which the agricultural engineers had been attending. Prof. I. D. Mayer of Purdue arranged the facilities for the meeting at the University, and Prof. William Aitkenhead welcomed the group when it assembled. Other agricultural engineers attending the meeting were: Prof. H. B. Walker of University of California, Prof. F. C. Fenton of Kansas State College, Prof. Henry Giese of Iowa State College, and Prof. R. U. Blasingame of Pennsylvania State College. Prof. H. P. Smith of Texas Agricultural Experiment Station could not be present. The veteran Committee A-5 members at the meeting were: Messrs. G. C. Bartells, R. F. Passano, R. S. Simmons, H. E. Smith, and C. D. Hocker.

ASTM Bulletins

TABLE OF CONTENTS—1937

Price of I.A.T.M. Proceedings Reduced

FOLLOWING a decision reached by the Permanent Committee of the International Association for Testing Materials, the Society has received a shipment of the Proceedings of the congress of the Association which was held in Zurich, Switzerland, in 1931. These Proceedings issued in two parts are being offered to members of the Society and others who may be interested, at the special price of $4 for both parts, this price including mailing charges. The Proceedings were originally listed at $13.

The volumes are both extensive ones—Part I, including a larger number of technical papers presented on the subject of metals and non-metallic inorganic materials (Groups A and B) comprises 1213 pages, and Part II made up of the papers on organic materials and questions of general importance (Groups C and D) covers 708 pages. Both volumes are bound in red cloth binding, page size $7\frac{1}{4}$ by $10\frac{1}{2}$ in. A coated paper is used for the volumes.

The papers are published in the language in which they were presented, namely, English, French or German. In addition each paper has a condensed abstract in each of the three languages. An interesting procedure followed in the Proceedings is that at the conclusion of the papers in each of the groups there is a general summary of the subject prepared by the presiding officer of the group.

Members who may wish to take advantage of the reduced price of $4 and obtain a copy of these valuable Proceedings are requested to send their orders to Society Headquarters.

Folders and Literature Received

FISHER SCIENTIFIC CO., 711 Forbes St., Pittsburgh, Pa. "More Modern Laboratory Appliances," a 90-page supplement to Fisher's large catalog on "Modern Laboratory Appliances." The new book presents equipment and supplies introduced since the publication of the general catalog, describing many appliances designed and manufactured by the Fisher Co. Brings up to date the general catalog. 89 pages.

HERMAN A. HOLZ, 167 E. Thirty-third St., New York City. A 16-page booklet on hardness tests of metals and metal products, giving "a review of the various methods and a description of the hardness testing machines most suitable for use in laboratory work and in routine production control." Covers especially the Vickers test and Brinell machines of original Alpha make.

LEEDS & NORTHRUP CO., 4901 Stenton Ave., Philadelphia, Pa. Catalog E-50B(2) 1937, describes deflection potentiometers and accessories for two principal uses: (1) for calibrating and checking d-c deflection instruments; (2) for lamp-efficiency testing. 8 pages.

FISH-SCHURMAN CORP., 250 E. Forty-third St., New York City. A 20-page catalog describing Jena fritted glass filters and apparatus, including a number of new Jena products not previously described in English printed literature. Includes information on bacteria proof filters, all-glass stirrer, A.S.T.M. sulfur determination apparatus and Stadler automatic still.

RUBICON CO., 29 N. Sixth St., Philadelphia, Pa. Bulletin No. 460, 12 pages, covers the Evelyn photoelectric colorimeter—a single-cell, direct-reading photoelectric photometer for increasing the accuracy, speed, and objectivity of colorimetric chemical analysis.

BOONTON RADIO CORP., Boonton, N. J. Bulletin A. A condensed catalog of measuring and testing instruments for the laboratory design and quality control of r.f. components and materials. 4 pages.

THE PYROMETER INSTRUMENT CO., 103 Lafayette St., New York City. Catalog No. 90 describing a new pyro micro-optical pyrometer and also bi-optical pyrometers. 6 pages.

BALDWIN-SOUTHWARK CORP., Paschall Station, Philadelphia, Pa. Bulletin No. 131, 44 pages, covers Southwark-Emery testing machines including historical sketch of the Southwark-Emery machine, compression testing machines, horizontal machines, torsion tester, grips and other testing tools. Bulletin No. 134, 4-page pamphlet describes the R. R. Moore high speed fatigue testing machine. Bulletin No. 145, 4 pages, covers the Rayflex fatigue testing machine.

Supplemental Exposure Tests of Plated Coatings on Non-Ferrous Metals

IN the spring of 1936, exposure tests in six locations were started upon plated specimens of non-ferrous metals described in detail in the 1936 report of the Joint Committee representing the A.S.T.M., American Electroplaters' Society and National Bureau of Standards.[1] Since that time regular inspections have been made by committee members and other interested persons.

The results of 15 months' exposure are in general consistent with previous observations upon plated coatings, especially the relation of thickness to protective value. The effects of other variables, such as methods of preparation and plating, were not in all cases conclusive. A conference was therefore held at the National Bureau of Standards on October 6, 1937, which was attended by over forty interested persons. Their recommendations for supplemental tests, subsequently adopted by the Joint Committee, may be briefly summarized as follows.

In recent years, especially in the automobile industry, so-called "bright nickel" solutions have come into extensive use. The resulting deposits are so bright as to require little or no buffing prior to chromium plating. Even though the compositions of all of these baths have not been disclosed, it was felt that the tests should include such coatings. Each manufacturer of a bright nickel plating solution in extensive use will be invited to supply his solution and to supervise its application at the National Bureau of Standards to appropriate specimens. All of these will be marked alike, so that the results of inspections will indicate simply whether the bright nickel deposits are, on the average, equal in protective value to the ordinary nickel deposits of the same thickness, and not which bright coating is the best.

Some specimens will be plated in commercial plants, to determine whether such deposits behave the same as similar specimens plated under laboratory conditions.

Some of the exposed specimens will be cleaned at intervals to determine their condition when dirt and products of corrosion are removed.

A very thin film of grease will be applied to a small proportion of the exposed specimens, in order to observe their behavior under conditions frequently applied to plated parts of automobiles.

A detailed program incorporating the above and other minor changes was circulated to the cooperating committees, and helpful suggestions were received. The specimens are now being plated, and it is hoped to start these supplemental tests in the spring of 1938.

[1] *Proceedings*, Am. Soc. Testing Mats., Vol. 36, Part I, p. 212 (1936).

EDITOR'S NOTE:—This article was prepared for the BULLETIN by Dr. William Blum, National Bureau of Standards, who is chairman of the Joint Committee on Exposure Tests of Plated Coatings on Non-Ferrous Metals.

***"The answer to almost any question is 90 per cent automatically self-evident if one takes the trouble to assemble and scrutinize the known or ascertainable facts which bear on it."*—General J. J. Carty.**

Proceedings Mailed Shortly to Members

PUBLICATION work on the *Proceedings* of the 1937 annual meeting is virtually completed and it is expected that the two extensive volumes will be distributed to each member of the Society within the next few days. As previously, the *Proceedings* are issued in two parts, Part I covering committee reports and all new tentative standards approved this year, while Part II gives the extensive technical papers.

Part I, which aggregates some 1370 pages, includes the annual reports of 46 standing committees and joint and sectional committees of which the Society is sponsor. Information on standardization and research programs of all of the committees is given. A number of the reports have papers appended covering important phases of committee work or related activities. Such reports include:

A-5 on Corrosion of Iron and Steel (Wire Test Program).
Fatigue of Metals (Nomenclature for Various Ranges in Stress in Fatigue).
Effect of Temperature on Metals (Long-Time Creep Tests; Discrepancies in the Load-Carrying Abilities of Carbon Steels at 850 F.).
Die-Cast Metals and Alloys (Brass Die Castings; Die Design Changes and Test Bars).
Light Metals and Alloys (Modulus of Elasticity; Methods of Testing Oxide Coatings on Aluminum).
Report of Committee C-9 on Concrete and Concrete Aggregates (Plastic Mortar Cubes).
Electrical Insulating Materials (Significance of certain tests).
Methods of Testing (Various Tests Applied to Sheet Metals; Yield Strengths Corresponding to Small Percentages of Set).
Spectrographic Analysis (Super-Purity Metals).

The above-mentioned appendices to committee reports and others which are included should be of particular interest to those concerned with the respective committee work. Part I also includes Doctor Fieldner's presidential address on the subject "Fuels of Today and Tomorrow." It also contains all tentative standards first published in 1937, and for convenience gives all proposed revisions of standards.

In describing Part II of the *Proceedings*, one mechanical feature should be noted, namely, that for the first time this volume which includes all of the 45 technical papers presented at the annual meeting is printed in double column format. Careful studies of legibility, etc., have indicated definite points in favor of double column style, and with this improved legibility there is also considerable saving effected in the number of pages. Part II, 1937, comprising some 707 pages, has been estimated to be the equivalent of about 900 pages, based on the style used in previous years.

This volume includes the Edgar Marburg Lecture on Plastics, the symposium on significance of tests of coal and extensive groups of papers covering metals and cement, concrete, masonry materials, etc.; several papers on asphalt and related materials and a group of papers on water, particularly boiler feedwater. In addition there are numerous other papers covering testing methods and the like.

Certain of the papers which could not be preprinted in advance of the annual meeting are, of course, given in full in Part II. Some of these cover tests for service stability of asphalt plank, West Texas asphalts, design of impact test specimens, American steam distilled wood turpentine, tensile strength of cast iron and an extensive contribution on plastic flow and volume changes of concrete.

1937 in Retrospect; Prospective 1938

(*Continued from page 6*)

analysis of ferro-alloys (A 104), particularly covering phosphorus in ferromanganese and ferrovanadium, aluminum in ferrovanadium, tungsten in ferrotungsten, and molybdenum in ferromolybdenum.

A new division of the committee will deal with materials not covered in the ferrous or non-ferrous divisions. It will cover application of special methods of analysis such as micro-analysis, chemical microscopy, photo-chemical and any of the newer techniques such as polarographic and fluorescent methods.

Since the value of the results obtained by chemical analyses are quite dependent upon proper sampling, the work of the division on sampling is vitally important to A.S.T.M. methods of testing and analyzing alloys. Its work has been divided into four subdivisions as follows: Basic forms—ingot, pig, slabs, lump, etc.; cast metals; mechanically worked metals; duplex, powdered, cathode and other special forms.

Spectrographic Analysis

In order to meet the need for broader application, two of the tentative methods for quantitative spectrochemical analysis of zinc alloy die castings (E 27) and high-grade pig lead (E 25) were revised on the recommendation of Committee E-2 on Spectrographic Analysis. Changes in the first case permit a closer quantitative determination of the amounts of minor constituents and impurities, and in the second specification, extend the scope to include other impurities than copper, bismuth, silver and nickel.

Appended to the 1937 report is a discussion of outstanding importance to all spectroscopists, covering sources and characteristics of super-purity metals which are so urgently needed as a base for the preparation of standards for quantitative spectrographic analysis. This report, prepared by a special subcommittee under the chairmanship of T. A. Wright, presents information on many metals of very high purity, including aluminum, antimony, bismuth, iron, magnesium, nickel, etc. Such information as was developed by the committee concerning form of the metal, its cost, the amount and its availability are covered. In an appended paper on "Super-Purity Metals" by Mr. Wright, he discusses various factors in connection with the study, including purity, analysis, form and distribution. This project of the subcommittee on standards and pure materials has as its primary purpose to make available metals which may serve as basic fundamental standards.

Copper Wires for Electrical Conductors

In its 1937 report, Committee B-1 on Copper and Copper Alloy Wires for Electrical Conductors has included certain dimensions and details of shapes for figure 8 trolley wire sections. It also draws attention to the fact that Class A wire covered in the specification for bronze trolley wire (B 9) is being furnished with 55 per cent conductivity instead of 40 per cent conductivity, as called for in the specifications. It was felt desirable to indicate that this wire is available.

During the year, the committee developed certain changes in the specifications for hard drawn copper alloy wires for electrical conductors (B 105) to clarify the intent that no undrawn joints would be allowed and also that methods other than brazing would be acceptable in making the joints.

Non-Ferrous Metals and Alloys; Corrosion

Committee B-2 on Non-Ferrous Metals and Alloys is studying copper-bearing lead for the manufacture of sheath for electrical cables and is collecting information on refined tin including forms in which it is available, its properties, and methods of sampling and analysis. A similar survey of refined antimony is under way.

Extensive revisions of the specifications for rolled zinc (B 69) were incorporated, in the form of a new tentative standard which will replace, when adopted, the existing standard. The new specification should prove more useful and conform to present trade practice. Revisions were adopted in the specifications for slab zinc (spelter) (B 6). They make provisions for extreme purity zinc and bring the specifications requirements into conformity with present-day practice.

Proposed specifications have been drafted for monel metal in sheet form while other studies involve nickel and high-nickel alloys in rods, bars, and sheets for general engineering construction.

The Committee on Corrosion of Non-Ferrous Metals and Alloys is continuing its study of the salt-spray test. It is hoped the paper by Messrs. Dix and Bowman on this test, in the Symposium on Corrosion Testing Procedures, and the discussion will assist the writing in the near future of a proposed method of testing.

The item of greatest interest among the varied activities of Committee B-3 during the past year has been the inspection of the six-year specimens of the subcommittee on atmospheric corrosion. The specimens from each of the nine test locations were assembled at the National Bureau of Standards in Washington, where changes in weight after an exposure of six years were measured and recorded. Data on tensile specimens are not yet available, but will be published in the 1938 annual report of the committee. It will be recalled that this constitutes the third examination of these specimens, other inspections having been made after periods of one year and three years.

Electrical-Resistance Alloys

During 1937 Committee B-4 on Electrical-Heating, Electrical-Resistance and Electric-Furnace Alloys revised the test for flexivity of thermoflex (thermostatic metals) (B 106). Other test methods are being prepared.

It has been decided to substitute a glass slide in the front of the enclosure around the test sample in the accelerated life test for metallic materials for electrical heating (B 76). The general adoption of the life test method has resulted in such an improvement in the life of alloys used in electrical heating, that it has been necessary to increase the temperature of test in order to bring the duration of the test within a reasonable length of time. The test method allows any temperature to be used, providing the time to burn out is of the order of 100 hr. or more. The increase in life of the 80 per cent nickel, 20 per cent chromium type of alloy has been such, that it has been necessary to increase the test temperature from 1950 F., which was general practice at the

time of adoption of the standard, to 2150 F. at the present time.

A proposed method of test has been completed for determination of the temperature coefficient of resistance of manganin strip.

Bend tests at high temperatures on structural materials for electric furnaces are under consideration, and tests are being made. A further program of tests for warpage is also being carried out at the University of Michigan.

The new Subcommittee VIII on Material for Radio Tubes and Incandescent Lamps has been very active and expects to have a number of methods of tests ready for submission as proposed tentative standards at the next annual meeting. These will cover filament, fine cathode tubes, mica parts, filament hook wire and a tungsten wire brittleness test. They are also making a study of different types of stiffness testers for wire and strip.

A new Subcommittee IX on the Effect of Controlled Atmospheres on Electric Furnace Resistors and Structures has been formed. Data have been collected on the effect of various atmospheres upon furnace resistors and hitherto unrecognized effects have been discovered. This work is to be the basis for a method of test for durability of resistor alloys exposed to controlled atmospheres at high temperatures.

Copper Alloys

An important achievement of Committee B-5 on Copper and Copper Alloys, Cast and Wrought, has been the completion of the new tentative standard (B 111) covering copper and copper-alloy seamless condenser tubes and ferrule stock. This new specification replaces standards (B 44), (B 56) and (B 104) covering seamless admiralty, Muntz metal, and copper-nickel alloy condenser tubes and ferrule stock, respectively. The standard on seamless 70-30 brass condenser tubes and ferrule stock (B 55) has been withdrawn because this specification has outlived its usefulness.

The committee has prepared a revision of the standard on brass sheet (B 36) which it is believed will be recommended during the coming year. It has also developed a revision of the specifications covering copper-silicon alloy wire for general purposes (B 99).

Consideration is being given to the preparation of specifications covering commercial tubes of various alloys other than condenser tubes and plumbing pipe, leaded brass sheet and strip, copper alloy wire, copper and copper alloy rods, nickel silver sheet, strip and extruded shapes and condenser tube plates of various alloys. Revisions are being considered in the requirements for the mercurous nitrate test in various specifications, as well as minor changes in the specifications for seamless copper tubing (B 68), copper water tube (B 88), and sheet copper silicon alloy (B 97). Specifications covering nickel silver casting alloys are being studied, as well as revisions in the requirements for cast bearing plates for bridges and structures (B 22).

Die Castings

The specifications for aluminum-base alloy die castings (B 85) were changed during the year on the recommendation of Committee B-6 on Die-Cast Metals and Alloys to show in an appendix physical properties for Alloys Nos. XI and XII, and minor changes were made in the specification requirements for magnesium-base alloy die castings (B 94).

Five tin-base and lead-base alloys are being studied to determine certain properties including tensile strength, creep, impact and hardness. A number of tests are in progress such as creep testing and endurance tests at elevated temperatures, and a report on the correlation of testing practices used on tin-base and lead-base alloys is expected to be presented.

Final arrangements for the atmospheric exposure tests of three zinc- and four magnesium-base alloys are being completed. A program is being laid out covering details of the casting methods, the identification and distribution of the specimens, the testing procedure and testing laboratories. Certain laboratories are conducting tests on original physical properties and will make the chemical analysis and steam test on the zinc-base die-casting alloys.

Light Metals and Alloys

A new tentative specification covering aluminum-base alloys in ingot form for permanent mold castings (B 112) was prepared and published through the work of Committee B-7 on Light Metals and Alloys, Cast and Wrought, and the existing specifications for aluminum-base alloys in ingot form for sand castings (B 58) were revised to bring them in line with present commercial practice. Requirements for aluminum-base alloys in ingot form for die castings are in course of preparation, this to be done in cooperation with Committee B-6. In the program on the testing of light metals, special attention has been given to the modulus of elasticity of sand-cast alloys and data appear in the appendix to the 1937 annual report. This indicates that "it seems reasonable to accept for practical purposes the value of 10,300,000 lb. per sq. in. for the alloys covered by the specifications for aluminum-base alloy sand castings (B 26). It is recommended that a modulus of elasticity value of 10,300,000 lb. per sq. in. be used for the alloys covered by the specifications for aluminum-base alloy permanent mold castings (B 108) and for aluminum-base alloy die castings (B 85).

An extensive discussion presenting data and information accumulated on methods of testing oxide coatings on aluminum also is given in the report. Other data obtained from various industries using aluminum and its alloys in order to determine requirements of the trade for anodized coatings are to be summarized and used in the study of test methods.

Cement

Committee C-1 on Cement, assisted by numerous cooperating laboratories, actively continued its studies of methods of chemical analysis. The data thus accumulated supported a number of actions relating to standards. The methods of chemical analysis of portland cement (C 114) were revised to include procedures for determining manganese and phosphorus. A portion of that tentative standard was advanced to standard, being made a part of the methods of sampling and testing (C 77). Very recently the committee has reported plans to recommend: (*a*) Advancing to standard the two present tentative methods for rapid determination of magnesia in cement, it being provided that the present Section 16 of C 77 is to govern in cases of disputes; (*b*) publishing as tentative, proposed methods for determining the potassium and sodium oxides and for determining the water-soluble alkalies in portland cement. A large number

of laboratories are now cooperating in a study of methods for determining the free lime in cement.

The specifications for natural cement (C 10) were quite generally revised. The specifications for portland cement (C 9) were also revised by deleting the fineness requirement. The committee recently reported the plan to recommend the deletion of the fineness requirement from the standard specifications for high-early-strength portland cement (C 74).

There is now being completed an extensive investigation of the proposed autoclave tests for portland cements. A number of laboratories, using 35 cements, studied such variables as duration of steaming, length of specimens, their age at test, consistency of mix, and agreement among laboratory results.

Much work has already been done in an uncompleted study of the water-solubility test for cements. The subjects of blended cements, slag cements, improvements of the present tentative specifications for masonry cement and the development of a bleeding test for cements have received study.

The committee for some months has been conducting tests, in accordance with the provisions of the high-early-strength portland cement specifications (C 74) to determine whether a certain material may be considered as non-harmful when used as an addition, subsequent to calcination, in the manufacture of high-early-strength portland cement. These tests are being performed by the Cement Reference Laboratory. This laboratory steadily continued its field inspection work, almost completing its fifth tour among cement laboratories. In that tour a greater number of laboratories has been involved than in any preceding tour.

Fire Tests

Regarding fire tests of lumber, further comparative studies are being made of the long-established timber and crib tests and the more recently proposed fire tube test. Other tests are under consideration and attention is being given to suitable forms of test specimen. The application of the various test methods will be investigated by six or more cooperating laboratories.

A new approach is to be made in studying a suitable method for testing fire doors on interior wall openings. The varying purposes to be accomplished for different situations has caused considerable difficulty in arriving at a method suitable for doors of different types of construction. Under certain conditions the spread of fire is the most important consideration. For other situations the transmission of heat through the door plays a more important part. And at other times the creation or transmission of smoke seems most important. An increasing number of tests in recent years, made chiefly to satisfy governmental requirements in New York City, is furnishing the committee with material for study.

Considerable information has already been secured by the subcommittee studying methods for testing acoustical and similar interior finishes. Tests on a range of different size samples mounted in a manner best designed to determine susceptibility to spread of flame and glow are contemplated.

The new tentative standard issued in 1937, covering tests of lumber for scaffolding (C 132), has met with some criticism which will have the consideration of the subcommittee in charge with the intention of modifying the specifications if found necessary or desirable.

Consideration has been given to some of the basic conditions governing size of test samples. The results of fire tests of similar constructions of different dimensions have been studied. Further examination and possibly also additional tests will be needed before conclusions are drawn.

Refractories

With the development of new refractories it has been necessary for Committee C-8 to revise the methods of chemical analyses. During the year the committee acted to have withdrawn the standard C 18 – 35, and substituted the new tentative standard C 18 – 37 T for the analysis of fireclay refractories, silica refractories, and high-alumina refractories. The methods for magnesite refractories were retained since they were brought up to date a few years ago. A study of the determination of FeO in chrome refractories is in progress and it is planned to revise the general methods of analysis of chrome refractories during the current year. A new method for testing cold crushing strength and modulus of rupture of refractory brick and shapes (C 133) was issued as a tentative standard.

The committee has worked on a method of test for size, warpage, and bulk specific gravity of refractory brick. This will be presented to the Society for approval as a tentative standard. The subcommittee on slagging has been reorganized and is actively engaged in an attempt to develop a standardized slagging method.

A new manual of A.S.T.M. Standards on Refractory Materials was prepared by Committee C-8, and published in November, 1937. All specifications, methods of testing and definitions under the jurisdiction of the committee are contained in the manual. The manual also contains a list of standard samples of refractory materials, and industrial surveys of service conditions of refractories. For the first time an industrial survey of conditions surrounding refractory service in the glass industry as it pertains to continuous bottle furnaces is included. It also includes a recommended procedure for calculating heat losses through furnace walls. At the present time, data are being collected to present an industrial survey of refractory conditions in lime burning kilns.

Manufactured Masonry Units

During the year, the merger of Committees C-3 on Brick and C-10 on Hollow Masonry Building Units was completed, resulting in the organization of the new Committee C-15 on Manufactured Masonry Units. The scope, as well as the organization of Committee C-15, is indicated by the subjects assigned to the subcommittees and working committees, as follows: *Subcommittees*—clay building brick; concrete units; sand-lime brick; paving brick; sewer brick; glazed brick and tile; structural clay tile. *Working Committees*—tests for brick prisms; freezing and thawing tests for masonry units; definitions for double bricks; and sizes for masonry units.

Since 1927, when the absorption requirements were dropped, the standards for clay and shale building brick have contained no classification or requirement relating to durability. In recognition of this deficiency, the existing standard specifications (C 62 – 30) contain a note stating that the classifications are based on strength and do not necessarily measure

weather resistance. Data published during the past three years seem to confirm the indications of previous investigations in showing a correlation between a measure of the degree of saturation of brick during simple soaking and resistance to frost action. The tentative specifications for building brick (made from clay or shale) (C 62 – 37 T) represent a thorough revision of the previous standard. In these specifications bricks are graded according to weathering qualities as predicted by performance in simple laboratory tests. The requirements are based upon the results of laboratory tests and field observations showing the relations between the behavior of bricks in freezing-and-thawing tests and natural exposure, and certain measures of water absorption and strength. It includes limitations on a saturation ratio, strength and total absorption. Although the committee is not yet ready to recommend the withdrawal of the present standard it is expected to be replaced by one which affords some protection to purchasers against the acceptance of bricks of inferior resistance to weathering.

The standard specifications for sand-lime building brick (C 73) also grade bricks according to strength and not according to weather resistance. Data made available to the committee recently indicate, however, that limitations on strength, qualities of aggregate and uniformity of structure provide a basis for predicting resistance to frost action. The committee is now balloting on a proposal to replace the standard by a new specification which includes a grading according to resistance to weathering.

In recommending the withdrawal of the previous standards for paving brick (C 7 – 30) and the publication of the Tentative Specifications for Paving Brick (C 7 – 37 T), the committee was prompted by new developments in the manufacture of brick and in methods of constructing brick pavements. The requirements for lugs and the list of standard sizes have been revised to be in accord with present practice. The new tentative specifications include, also, several revisions in form and arrangement which it is hoped will meet with approval of users of the specifications.

The new Tentative Specifications for Sewer Brick (Made from Clay or Shale) (C 32 – 37 T), represent a thorough revision of the old standard, which was withdrawn. The results of experience and test data on bricks accumulated during the life of the old standard showed that the absorption requirements were unduly rigid with respect to those pertaining to strength properties. In the tentative specifications, the requirements for strength were made more rigid and those for absorption less severe. These changes tend to make easier the manufacture of bricks meeting the requirements, irrespective of the kind of raw materials and manufacturing processes used. The data available also indicate that the requirements of the tentative specifications grade bricks more closely in accordance with the required service properties than did those of the old standard.

Investigations at Columbia University and Rensselaer Polytechnic Institute are being sponsored by Committee C-15. Tests at Columbia University, under the direction of Prof. W. J. Krefeld, are planned to develop information on the effect of shape of brick masonry specimens on the compressive strength. Those at Rensselaer, under the direction of Prof. T. R. Lawson, will include comparisons of the effects of different materials and methods for capping structural clay tile on the apparent compressive strengths.

Concrete and Concrete Aggregates

In order to fill the long-felt need for standard requirements for lightweight aggregates, Committee C-9 developed during the past year, the new specifications for lightweight aggregate for concrete (C 130). These were based upon extensive study of the necessary requirements. The new test for abrasion of coarse aggregate by use of the Los Angeles machine (C 131) was prepared with the cooperation of Committee D-4 to meet a need for a more accelerated abrasion test which would introduce the effect of impact more decidedly.

A number of existing specifications and tests were revised including those covering concrete aggregates (C 33) and the tests for soundness of aggregates by use of sodium sulfate (C 88) and magnesium sulfate (C 89), the two latter being combined into a single method entitled Tentative Method of Test for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate (C 88 – 37 T).

There were published as tentative proposed revisions in standards involving the method of making and storing compression test specimens of concrete in the field (C 31) and curing portland-cement concrete slabs with calcium chloride admixture (C 82) and by surface application (C 83); also the specifications for ready-mixed concrete (C 94).

Committee C-9 expects to submit during 1938 a new method for determination of yield of concrete, a procedure for making freezing and thawing tests of aggregates, and a proposed method for sieve analysis of fine and coarse aggregate, the latter being worked out in cooperation with Committee D-4.

Two technical papers are in course of development in the committee, one covering observations on the diffusion of water vapor through concrete, the other, the effect of different types of construction joints on durability of concrete.

Gypsum

For several years, Committee C-11 on Gypsum has been conducting investigative work on Keene's cement and gypsum plasters with the result that it plans to recommend a number of changes in the present standard specifications for Keene's cement (C 61), specifications for gypsum plasters (C 28) and in the standard methods of testing gypsum and gypsum products (C 26).

There never has been a standard method for the determination of the sand content in set plaster. A method, developed several years ago, employing ammonium acetate has been found to be both accurate and consistent. The committee therefore plans to recommend that this method be incorporated as a tentative revision in the present standard methods of testing gypsum and gypsum products (C 26).

Natural Building Stones and Slate

During the coming year Committee C-18 on Natural Building Stones and Slate plans to recommend the adoption as standard of the method for compression testing of natural building stone (C 98) and action is planned to withdraw one of the existing tentative test methods covering the tension testing of natural building stone (C 103). Considerable work has been under way on a new procedure covering wear tests which the committee hopes to recommend as a new tentative standard. The project involving the standardizing of commercial samples is proceeding satisfactorily and

a proposed uniform cubing procedure is expected to come up for action at the next meeting of the committee.

The development of specifications governing classification and grading rules for certain of the products in the scope of the committee may also result in some recommendations during the year.

Paints, Varnish, Lacquer, and Related Products

The past year was a most productive one for Committee D-1 on Paint, Varnish, Lacquer, and Related Products. Four new tentative standards were published as tentative, including two specifications for zinc sulfide magnesium pigment and titanium magnesium pigment, new varieties of pigments that are attaining commercial recognition. Revisions in the form of separate tentative specifications were developed for basic sulfate white lead (D 82); a complete revision of the standard method (D 307) was issued in the form of a new tentative standard entitled Method of Analysis for Spectral Apparent Reflectivity of Paints (D 307 – 37 T). This includes a number of improvements and brings the test up to date. The new methods of analysis for zinc yellow pigment (zinc chromate yellow) (D 444) were developed in connection with the preparation of specifications for this material which has come into prominence in recent years as a constituent of priming paints for metals.

The committee has conducted a letter ballot on three proposed new standards; also revisions as tentative of four standard specifications. The proposed standards cover a test for reactivity of paint liquids and specification requirements for C.P. zinc yellow (zinc chromate) and for para red toner. Revisions will involve a new tentative specification for reduced para red to supersede the present commercial para red specification (D 264). Three of the lacquer and lacquer materials specifications are under revision.

Projects on accelerated tests for protective coatings are continuing, including work on house paint exposure tests for gloss retention and chalking and on accelerated methods for metal protective paints.

Cooperative analyses are contemplated on samples of cuprous oxide. In addition, methods of test are to be prepared for the routine analysis of para red toner and reduced para red to accompany specifications already drafted for these materials. A method will also be studied for determining the consistency of paint and it is planned to secure information on methods for measuring abrasion resistance and adhesion.

Consideration will be given the desirability of setting up tentative specifications for V. M. and P. naphtha and also for high-solvency naphtha, to include procedure for kauributanol test, aniline number and evaporation tests.

Activities on physical properties of materials include a set of definitions of terms relating to gloss; the development of a description of method or methods of test for gloss; and a proposed definition in terms of a standard method of what is meant by finishes of high gloss, eggshell or semi-gloss and flat; with specifications covering tolerances for each type.

In its work on cellulose ester coatings, progress has been made in establishment of standard conditions for a dilution ratio test for solvents and development of a new piece of test equipment. Details of a proposed procedure for testing the flexibility of lacquers by means of a conical mandrel were published in the December ASTM BULLETIN, in a paper by H. G. Arlt.

Petroleum Products and Lubricants

Four test methods were accepted for publication as tentative in 1937 as the result of the work of Committee D-2 on Petroleum Products and Lubricants; these cover kinematic viscosity (D 445), conversion of kinematic to Saybolt universal viscosity (D 446), distillation of plant spray oils (D 447), and test for vapor pressure of petroleum products (Reid method) (D 323). The latter is a consolidation and revision of the former tests for vapor pressure of natural gasoline and motor and aviation gasoline. Revisions were incorporated in the test for knock characteristics of motor fuels (D 357) and the test for melting point of paraffin wax (D 87); also improvements in the procedure for free alkali or free acid in the standard methods of analysis of grease (D 128).

Two proposed methods published as information cover a test for dropping point of lubricating greases and test for unsulfonated residue of plant spray oils.

Four viscosity-temperature charts, two for kinematic viscosity and two for Saybolt universal viscosity, with various ranges in viscosities and temperatures, were developed and published. These charts are being widely used.

The committee is at work on an extensive list of important projects. Test methods are being developed to determine whether engine oil or hypoid-gear lubricant is corrosive or will become corrosive in service; additional methods for determining kinematic viscosity are being considered and methods of gaging are being studied. The committee plans to undertake further work on the dropping point of lubricating greases; improvement in grease worker for penetration method; determination of consistency of very soft greases; and development of a laboratory method indicative of the point at which gear lubricants might channel in service. The new subcommittee on aniline point is working on a testing procedure for determining this point for petroleum products; and test methods for gasoline pertaining to acid heat, gum stability, and tetraethyl lead are in course of development. Specifications for Stoddard solvent and for Diesel fuel and a revision of existing specifications for fuel oil are other projects before the committee.

Gaseous Fuels

The work of Committee D-3 on Gaseous Fuels has been pushed during the past year. The activities have been assigned to various subcommittees involving collection and measurement of gaseous samples and the determination of calorific value, specific gravity, density, impurities, and water vapor content of gaseous fuels. One of the subcommittees is concerned with the complete analysis or chemical composition. Several of the groups have developed proposed definitions some of which have been approved by letter ballot and referred to the main committee for consideration. In order to develop helpful information the committee has made use of questionnaires and has consulted a number of authorities and references.

A test to determine the effects upon the accuracy of gas measurements brought about by changes in its relative humidity are under way, and consideration is being given to the design and construction of a special calorimeter to give highly accurate heating value data under controlled conditions. The group working on impurities has a particularly extensive program which includes the formulation of meth-

ods for the determination of impurities. A tentative definition of impurities has been developed which among other factors points out that "it is possible for a constituent of a fuel gas to be desirable at one time and undesirable at another time."

Road and Paving Materials

Included in the standardization work completed in 1937 by Committee D-4 on Road and Paving Materials was a new test for abrasion of coarse aggregate by use of the Los Angeles machine (C 131), in cooperation with Committee C-9, and new tentative specifications for standard sizes of coarse aggregates for highway construction (D 448) which replaces two existing specifications, D 63 and D 64. On the recommendation of the committee, jointly with Committee C-9, the tentative test for determination of amount of material finer than No. 200 sieve in aggregates (C 117) was adopted as standard replacing two existing standard methods. The tentative specifications for concrete for pavements (D 366) were withdrawn since they were essentially construction specifications and in accordance with the understanding reached with the American Concrete Institute the work has been turned over to that organization.

Six proposed new specifications covering crushed stone and crushed slag for waterbound base and surface course, bituminous macadam base and surface course and bituminous concrete base and surface course have been developed. At least four of these are expected to be recommended as new tentative standards in 1938. Other proposed standards which have been drafted include tests for heterogeneity of asphalt by the Oliensis spot test, new specifications for tars, and testing procedures for asphalt planks.

Coal and Coke

Two new methods covering drop shatter test and tumbler test for coal (D 440 and D 441) were issued as new tentative standards during the year on the recommendation of Committee D-5 on Coal and Coke. The shatter test is suitable for testing both a standard size of different coals and for testing different sizes of the same coal, and the tumbler test method is intended for determining the relative friability of a particular size of lump coal. Tentative revisions were approved in the sampling methods D 21 and D 271, the changes providing a means for mechanical crushing and reduction of gross samples of coal and specifying the minimum amount of minus 4 mesh coal to constitute a laboratory sample.

The method of determining fusibility of coal ash, a part of the methods of sampling coal (D 21), is being revised to give specific furnace requirements and mention certain commercial furnaces which the committee has found by test to be satisfactory. Silicon carbide, proposed as an inert material for the agglutinating value test will be checked in cooperative tests by different laboratories.

The committee will continue its consideration of factors that influence the accuracy of coal sampling with particular regard to the size of increment, number of increments, and size of gross sample required to give a sample of specified accuracy for coals of varying ash content. The committee is following closely all work done on coal sampling in this country and abroad, with particular attention to the work being done in England under the general direction of the British Standards Institute.

A draft of a procedure for testing dustiness is being tried out in the laboratories of the Battelle Memorial Institute, in cooperation with the committee.

Investigations are being continued on methods of testing plasticity and swelling of coal when heated, in connection with the use of coal for coke-making and as affecting its burning characteristics under fuel bed conditions. Swelling or expansion of coal is important in the selection of coals for coke-making, as strongly swelling coals cause injury to the walls of the ovens.

Since the ignition temperature of coal and coke is believed to be related to the burning characteristics of fuels in fuel beds, and laboratory tests for determination of ignition temperatures of fuels are necessarily very empirical in nature and require close standardization, a new subcommittee is to develop proposed procedures.

The adoption as standard of the specifications for classification of coals by rank (D 388) and by grade (D 389) with revisions incorporated in each, completes the current work of the Sectional Committee on Classification of Coals with the exception of the preparation of definitions of varieties of coals. Substantial progress on such definitions has been made by the Technical Committee on Nomenclature. These definitions are to include common banded coal, splint coal, cannel coal, and boghead coal. Tentative definitions for these varieties of coal will probably be recommended to the Society at the next annual meeting.

Paper and Paper Products

The recently authorized Committee D-6 on Paper and Paper Products held its organization meeting in New York City on June 28 and elected as officers: Chairman, R. C. Griffin, Arthur D. Little, Inc.; Vice-Chairman, M. A. Krimmel, Hammermill Paper Co.; Secretary, L. S. Reid, Metropolitan Life Insurance Co.

The scope of the committee has been defined as "the study, review and adoption of general testing methods; definitions of terms and nomenclature relating to paper and paper products; the study of use requirements and the significance of test results; the study of the need for specifications and the preparation of specifications in those fields for which there is need."

The committee at the outset has adopted two very definite policies. First, it does not propose to undertake the preparation of any specification unless there appears to be a real demand for it. Second, the committee is very desirous of avoiding conflict with or duplication of the work of other bodies. It is particularly desirous of cooperating with the Technical Association of the Pulp and Paper Industry. As evidence of that desire TAPPI has been invited to have an official representative on Committee D-6 and has appointed its vice-president, Wm. R. Maull, Dill & Collins, Inc., Philadelphia.

Four subcommittees have been appointed and two of them are actively engaged on carefully prepared work programs. Subcommittee I on Methods of Testing, under the chairmanship of W. E. Emley of the National Bureau of Standards, Washington, is undertaking the critical study of the various paper testing procedures already adopted and published by TAPPI with view to their adoption or adapta-

tion as ASTM standards. Subcommittee IV on Container Grades of Fiberboard and Fiberboard Containers, under the chairmanship of Don L. Quinn, Chicago, already has eight proposed tentative standards well under way. These have largely to do with test methods. The second phase of its program contemplates research work leading up to the preparation of standards for containers based on performance tests and is expected to be started during the coming year.

Timber

In addition to its recommendation that the proposed test for tar acids in creosote and creosote-coal tar solutions (D 453) be proposed as a new tentative standard, Committee D-7 on Timber also took action to have adopted as standard existing tentative specifications for timber piles (D 25) and for structural wood joist and plank, beams and stringers, posts and timbers (D 245). The first-named specifications are in substantial agreement with requirements developed by the A.R.E.A. and the American Association of State Highway Officials and the specifications D 245 have been approved and adopted by the A.R.E.A.

The committee is investigating the definitions for knots with particular reference to hardwoods in order to clarify methods for measuring knots in both structural timber and piles. Work on the determination of moisture in lumber is being continued. Certain new methods have been developed and are being studied.

Bituminous Waterproofing and Roofing Materials

Five new tentative specifications and tests were issued in 1937 as a result of the work of Committee D-8 on Bituminous Waterproofing and Roofing Materials. The committee also developed revisions in nine of its existing tentative specifications. Two of the new standards are test methods covering sieve analysis of granular (D 451) and non-granular (D 452) mineral surfacing for asphalt roofing and shingles. Two of the new specifications are important consolidations of previously existing specifications, the one covering asphalt for damp-proofing and waterproofing (D 449) replacing the former specifications covering asphalt for use in damp-proofing and waterproofing below (D 40) and above (D 144) ground level. The new specifications for coal-tar pitch for roofing, damp-proofing and waterproofing (D 450) replace six former specifications. The new requirements conform to present practice in eliminating differential requirements for type and use.

Current projects on which the committee is working include a study of methods of determining consistency of various bituminous coatings for cold application and formulation of tests for emulsions, namely, resistance to water action and ability to withstand flow at elevated temperatures. Work in this field resulted in the new tentative methods of testing films deposited from bituminous emulsions (D 466). Data resulting from cooperative tests on bituminous emulsions appear in the 1937 report.

Electrical Insulating Materials

Standardization and research work on electrical insulating materials was carried forward actively in 1937 through the intensive work of Committee D-9 on Electrical Insulating Materials, and there are a large number of projects currently under way. The work resulted in two important new standards, published as tentative in 1937, covering phenolic laminated sheet for radio applications (D 467) and pin-type, lime glass insulators (D 468). In addition revisions were developed in nine existing standards and tentative standards.

The list of active projects under way is such a lengthy one that only a few can be listed here. Further details on many of the items are given in the current committee report. In the field of insulating varnishes, paints, and lacquers, work will continue on test methods for true electrical properties of shellac and a procedure for measuring the impregnating property of varnish is being developed. A new test method for acetone extraction of molded insulating materials is anticipated during 1938; also, a test method for arc resistance. Work on tests for shrinkage of molded materials is to be completed.

In the work on plates, tubes and rods, specifications for laminated phenolic tubing for radio use are being drafted and the conditioning which should be specified for specimens of vulcanized fiber for the various tests is to be determined. Work in progress on insulating mineral oils includes methods for gas content, power factor of treated paper and the study of the dielectric strength test procedure. A study is to be made of a dye penetration test of porcelain.

The committee plans to revise extensively the tentative methods of testing sheet, tape, and molded insulating materials for dielectric strength (D 149) and make them general test methods to which other material standards may refer. The work on insulating papers and fabrics involves several projects including revision of the present acidity method, the possibility of measuring a stack of paper instead of a single sheet for thickness, and the matter of high-temperature testing is to be completely reviewed during the year.

The new subcommittee on conditioning plans to recommend definite temperature and relative humidity requirements to be incorporated in the methods of tests for resistivity of materials. The work on conditioning for Izod impact strength test is expected to be completed.

Rubber Products

Several of the active projects which Committee D-11 has had under way resulted in important standardization recommendations. Some of these include new tentative standards for rubber gloves for electrical workers (D 120), for insulated wire and cable: heat-resisting rubber compound, (D 469) and methods of testing rubber hose (D 380) and rubber wire and cable (D 470). Another important new standard for which there has been a pronounced need is the new test for changes in properties of rubber and rubber-like materials in liquids (D 471). A new method for air pressure heat test of vulcanized rubber (D 454) was issued. This is considered to be very useful for service evaluation of rubber compounds designed to resist heat and oxidation. The methods for testing rubber hose are a consolidation and amplification of two former standards. They include additional tests for types of hose not previously covered. The major changes incorporated in the rubber gloves specifications, which new tentative standard is in effect a revision of a former standard, include an accelerated aging test and

increase in certain physical properties. The new methods of testing rubber insulated wire and cable (D 470) resulted from the separation of testing procedures from the specifications for the materials. It was believed that the utility of both the specifications and test methods would be improved and that the new set-up would avoid some duplication.

In its program of current work is a glossary of terms for rubber so that there will be recorded terms that will be recognized as standard; also, a procedure for testing the resistance of rubber to light. There is considerable controversy on this subject, an indication of the need for a standard procedure. Another important project is the study of rubber cements and natural rubber latex. The committee is cooperating with the Crude Rubber Committee of the American Chemical Society in its work on rubber latex. New subcommittees are being organized to develop standards, particularly testing procedures, covering hard rubber and sponge rubber.

Soaps and Detergents

Considerable progress has been made by Committee D-12 on Soaps and Detergents. In its first annual report presented at the 1937 Annual Meeting, there were recommendations covering four new tentative specifications, proposed methods of sampling and chemical analysis of soap and soap products, and a number of definitions and terms.

As a result of a discussion at its latest meeting, the committee plans to recommend the adoption of three of the tentative specifications covering caustic soda (D 456), modified soda (sesquicarbonate type) (D 457) and soda ash (D 458). Changes are to be made in the other specification covering milled toilet soap.

The committee's program of development of test methods is making good headway judging by its decision to recommend as tentative, proposed methods for the analysis of sulfonated oils published for information in last year's report, new methods for analysis of potash, and for determining the size of soap particles. In its work on definitions, the committee has indicated that it would welcome especially comments on terms for detergents, builders, and scouring.

Other work which Committee D-12 now has under way involves the preparation of standardized requirements for industrial soaps (both chip and powder), soap powders and built soaps. Testing methods for carbon dioxide in soaps and the iodine value of fats are being studied.

Textile Materials

The rapidly growing interest in the work of Committee D-13 on Textile Materials is evidenced by a number of factors—committee membership is now at a peak, its meetings are unusually well attended and the demands of industry for standardized specifications and tests have resulted in an exceedingly active program of work. At its two meetings in 1937 (each extending over three days) a number of important technical papers were presented, with two symposiums respectively on "Atmospheric Conditions" and "Test Methods." Articles on these meetings have appeared in previous BULLETINS.

Four new standards were issued during the year covering test methods for wool felt (D 461), wool and part wool fabrics (D 462), volumetric determination of copper (D 463), and specifications and methods of test for fineness of wool tops (D 472). The last named, establishing scientific specifications for fineness values, is considered of particular importance in the worsted industry.

Included in the five standards formerly adopted under the recommendation of the committee, is a new one on specifications and tests for tire fabrics other than cord fabrics (D 122). This standard is a combination of three former specifications and test methods.

A new section has been formed to undertake work on staple fiber and spun rayon. While it is not possible to list all of the projects before the committee (some 30 of these were mentioned in the December BULLETIN in an article on the recent D-13 meeting in New York City) some of the more important ones are as follows:

Development of methods of test for evenness of cotton yarns; strength of heavily plied cotton yarns; sizing in fabrics; rayon staple and spun rayon yarns; laboratory method for shrinkage in grease wool; length of wool fibers; fineness of mohair; woolen yarns mixed with other fibers; weight of clean pile yarns and backing material and tuft length for carpets; strength and other properties of jute yarns, twines and roving. Studies are being made on chemical tests for spotting, bleeding and crocking of carpets; water resistance of textiles; fastness to light of colored textiles; and determination of tussah silk and casein fiber.

Other matters are: study of moisture regain in cotton yarns; checking of methods of testing consumer fabrics against actual wear; minimum strength standards for rayon fabrics for wearing apparel; definitions for wool, sheetings, broadcloths, toweling, etc.; study of tolerances for standard temperature and relative humidity; classification of carpet wools; machine wear tests on carpets; study of a number of tests for desired precision; specifications for diaphragm bursting testers; and a study of the relation between rate of loading constant specimen-rate-of-load type testing machines and the strength of cotton yarns.

Naval Stores

As a result of an extensive series of cooperative tests in which the laboratories of eight members of Committee D-17 on Naval Stores participated, two new methods have been accepted as tentative covering acid number of rosin (D 465) and saponification number of rosin (D 464). Before the methods are recommended for adoption as standard, the committee feels that another series of tests should be undertaken.

The committee anticipates submitting as proposed new standards during the coming year methods for sampling and grading rosin for analysis. Proposed methods for the determination of ash and unsaponifiable matter have also been drafted.

Soils

Committee D-18 on Soils for Engineering Purposes which was formally organized late in 1936 is intensively reviewing the nine tentative tests in its charge, with the object of determining their acceptability for adoption as standard during the coming year. All of the eleven subcommittees are compiling lists of terms and assisting in the development of tentative definitions and symbols, at the same time reviewing available literature on the various subjects.

Because the science of soils is relatively new, progress in the development of proposed tests may be slow. In its work on stabilization of soils the committee will study tests for freezing and thawing, wetting and drying, swell and shrinkage, percentage of voids and density. Consideration of tests for compressibility and elasticity are to begin. Another project involves the investigation of stabilometer tests for the determination of internal stability. Test procedures and apparatus used in the field and laboratory for load capacity of soil and bearing capacity of piles will be investigated. Involved in the work on drainage is a study of soil properties which determine rates of movement of soil moisture by percolation or capillary flow.

Water for Industrial Uses

The work of Committee D-19 on Water for Industrial Uses has included chiefly the completion of proposed test methods including general principles governing sampling and methods for the determination of calcium, magnesium and chloride ions in water. It is expected that the "introduction," "scope" and "general principles" of methods of sampling will be referred by the subcommittee in charge to the parent committee for approval. Further work in this field will involve the preparation of methods covering the sampling of water in various states: liquid, vapor and ice.

There is probably sufficient practical and research data available to undertake standardization of methods for determining dissolved oxygen, and standardization is also possible on the determination of iron, alumina and manganese, largely as a correlation with the methods for calcium and magnesium.

A new subcommittee on classification is being organized to develop standard methods of expressing analytical data secured from the analysis of water and the interpretation of the analysis; also, the classification of water from the use standpoint. The desirability of this work was indicated at the round-table discussion on the interpretation of water analysis held during the A.S.T.M. annual meeting in June.

Methods of Testing

At the 1937 annual meeting a Symposium on Consistency and a Round-Table Discussion on Precision and Accuracy were sponsored by Committee E-1 on Methods of Testing. The nine technical papers in the Symposium reviewed current practices in the measurement of rheological properties of a large number of materials with particular emphasis on the use and advantages obtainable from fundamental units of measurement. The significance and use of the terms "precision," "accuracy," "sensitivity," and "reproducibility of results" were critically considered from the technical viewpoint at the round-table meeting.

A new Technical Committee X on Conditioning is now being organized for the purpose of promoting standardization and providing a clearing house of information.

On the recommendation of Committee D-15 on Thermometers and Laboratory Glassware and with the approval of the Executive Committee, the functions of Committee D-15 have been transferred to Committee E-1 and assigned to a new Technical Committee XII on Laboratory Glassware. This new Committee E-1 activity is discussed in detail elsewhere in this BULLETIN.

In connection with its studies of mechanical tests, the committee completed a series of cupping tests of sheet metals for ductility, the results of which are now being studied. Detailed information obtained during the past three years on the usefulness and limitations of various tests as applied to thin sheet metals was presented in a final report.

Following the informal round-table discussion on impact testing held at the annual meeting, plans are now under way for a formal symposium on this subject to be held at the 1938 annual meeting in Atlantic City.

Tests of metals at different rates of strain are being planned as well as a study of "lag" effects in different types of testing machines. The committee is planning a further study of methods of determining elastic strength of metals for parts in which only a very small amount of inelastic action is allowable.

A Special Committee has been appointed to study the Tentative Method of Test for Softening Point by Tapered Ring Apparatus (E 28 – 36 T). All standing committees interested in this test have designated representatives on this Special Committee, which will consider the several comments and suggestions received concerning the method and recommend any changes that may be considered desirable to improve it further.

Foreign Standards Recently Issued

STANDARDS issued by a number of engineering and technical organizations in foreign countries are received by the Society as they are adopted. Since members of the Society may be interested in knowing that such standards are available they will be listed as received in the ASTM BULLETIN.

During the past month the following standards have been issued by the British Standards Institution and the Standards Association of Australia:

BRITISH STANDARDS

Method and Tables for Brinell Hardness Testing (No. 240 – 37).

Specifications for Steel Bearing Plates for Flat Bottom Railway Rails (No. 751 – 37).

Specifications for Salt-Glazed Glass (Vitreous) Enamelled Fireclay Pipes (Including Taper Pipes, Bends and Junctions) (No. 540 – 37).

Specifications for Earth Colors for Paints:
Natural Sienna (Raw and Burnt) (No. 312 – 37),
Natural Umber (Raw and Burnt) (No. 313 – 37),
Vandyke Brown (No. 319 – 37),
Ocher (No. 337 – 37).

Specifications for Black and Purple Oxides of Iron for Paints:
Black Oxide of Iron (No. 306 – 37),
Purple Oxides of Iron (No. 339 – 37).

Specifications for Black (Carbon) Pigments for Paints:
Carbon Black (No. 284 – 37),
Bone Black (No. 285 – 37),
Vegetable Black (No. 286 – 37),
Lamp Black (No. 287 – 37),
Mineral Black (No. 288 – 37).

AUSTRALIAN STANDARDS

Specification for Carbon Tetrachloride (No. K. 56 – 37).

Terms and Definitions Used in Timber Grading Rules (No. O. 1 – 37).

Provisional Approval and Test Specification Definitions and General Requirements for Electrical Materials and Equipment (No. C. 100 – 37. P.).

NEW MEMBERS TO JANUARY 6, 1938

The following 43 members were elected from November 15, 1937, to January 6, 1938:

Company Members (12)

ANDERSON-PRICHARD OIL CORP., B. I. Scoggin, Asphalt Technician, 1000 Ramsey Tower, Oklahoma City, Okla.

ATLANTIC TERRA COTTA CO., W. H. Powell, President, High St. and Buckingham Ave., Perth Amboy, N. J.

COMMONWEALTH PORTLAND CEMENT CO., Norman Saville, Plant Engineer, Portland, N. S. W., Australia.

DIAMOND SPRINGS LIME CO., E. E. Fout, Sales Manager, 100 Howard St., San Francisco, Calif.

DRIVER CO., WILBUR B., C. L. Mantell, Technical Director, 150 Riverside Ave., Newark, N. J.

EDISON ELECTRIC INST., Albert E. White, Department of Engineering Research, University of Michigan, Ann Arbor, Mich. For mail: 420 Lexington Ave., New York City.

LABORATORIES OF CHARLES L. W. PETTEE, C. L. W. Pettee, Proprietor and Chemist, 296 Homestead Ave., Hartford, Conn.

MICHIGAN STEEL TUBE PRODUCTS CO., C. E. Miller, President, 9450 Buffalo St., Detroit, Mich.

PENNSYLVANIA COAL AND COKE CORP., J. M. Townsend, Vice-President, 70 E. Forty-fifth St., New York City.

SNELL, INC., FOSTER D., F. D. Snell, President, 305 Washington St., Brooklyn, N. Y.

UNITED LABORATORIES, R. N. St. John, Director, 240 N. St. Francis St., Wichita, Kans.

ZEISS, INC., CARL, S. Meyer, Vice-President, 485 Fifth Ave., New York City.

Individual and Other Members (30)

ARNOLD, C. N., Research Engineer, Blaw-Knox Research Laboratory, Groveton, Pa. For mail: 154 Irwin Ave., Ben Avon, Pa.

BENCOWITZ, I., Research Chemist, Texas Gulf Sulphur Co., Newgulf, Wharton County, Tex.

BENNETT, J. G., Director, Combustion Appliance Makers Assn., 54 Victoria St., London, S. W. 1, England.

BULLARD, C. F., Material Standards Dept., Eastman Kodak Co., 343 State St., Rochester, N. Y.

COMESS, SAM, Testing Engineer, Mid-West Engineering Co., 1225 W. Second St., Davenport, Iowa.

CURRIE, L. M., Director, New Products Division, National Carbon Co., Cleveland, Ohio.

DALE, D. R., Director of Research, The S. M. Jones Co., Toledo, Ohio. For mail: 4304 Overland Parkway, Toledo, Ohio.

EICKHOFF, A. J., Chemist, National Bureau of Standards, Washington, D. C.

ESCUELA DE INGENIEROS, Enrique Laroza, Director, Casilla 1301, Lima, Peru.

GREGORY, HOWARD, Manager, Pittsburgh Testing Laboratory, 51 Allen St., Buffalo, N. Y.

GRIFFITH, D. L., Chemist and Metallurgist, Hudson Bay Mining and Smelting Co., Ltd., Flin Flon, Man., Canada.

HOLT, R. S., New Orleans Representative, Pittsburgh Testing Laboratory, 816 Howard Ave., New Orleans, La.

INSTITUT FRANCAIS DU CAOUTCHOUC, L. Enderlin, Directeur du Laboratorie, Place Marcellin Berthelot, Paris 5e, France.

MAXFIELD, L. S., Research Engineer, Veeder-Root, Inc., Hartford, Conn. For mail: P. O. Drawer 1020, Hartford, Conn.

MCKINNEY, P. V., Senior Industrial Fellow, Mellon Institute of Industrial Research, Pittsburgh, Pa.

MITCHELL, JOHN, Manager, Alloy Bureau, Metallurgical Division, Carnegie-Illinois Steel Corp., Chicago, Ill. For mail: 11519 S. Bell Ave., Chicago, Ill.

MOSES, D. V., Chemical Engineer, Process Section, E. I. du Pont de Nemours and Co., Inc., Ammonia Dept., Box 1437, Charleston, W. Va.

OPENSHAW, J. EDWARD, President, Openshaw & Bennet, Ltd., 420 Lagauchetiere St. West, Montreal, P. Q., Canada.

ORTHMANN, AUG. C., President and Director, The Orthmann Laboratories, Inc., 647 W. Virginia St., Milwaukee, Wis.

PADDOCK, O. H., Manager, Development Dept., Libbey-Owens-Ford Glass Co., Rossford, Ohio.

PAGE, E. W., Manager, Industrial X-ray Dept., General Electric X-ray Corp., 2012 Jackson Boulevard, Chicago, Ill.

RICKER, H. A., Mechanical Engineer, Canadian Westinghouse Co., Hamilton, Ont., Canada.

RITCHIE, G. G., Fuel Service Engineer, The Chesapeake & Ohio Railway Co., Richmond, Va.

ROGERS, A. T., Chief, Concrete Division, District of Columbia, Building Dept., Washington, D. C. For mail: 1401 Columbia Road, N. W.

ROSINGER, ARTHUR, Assistant Director of Research, Natural Products Refining Co., 902 Garfield Ave., Jersey City, N. J.

STALEY, H. R., Instructor, Massachusetts Institute of Technology, Room 5-229, Cambridge, Mass.

UNIVERSITY OF VIRGINIA LIBRARY, University Station, Charlottesville, Va.

VANDERWERP, HARRY L., Research Engineer, Medusa Portland Cement Co., Wampum, Pa.

VOGEL, K. E., Vice-President and General Manager, Omaha Steel Works, Omaha, Nebr.

WEBB, C. EARL, Division Engineer, American Bridge Co., Room 1334, 208 S. La Salle St., Chicago, Ill.

Junior Member (1)

ALLAN, R. W., Chemist, American Gum Importers Assn., Brooklyn, N. Y. For mail: 91-20 - 139th St., Jamaica, N. Y.

PERSONALS . . . News items concerning the activities of our members will be welcomed for inclusion in this column

S. C. HOLLISTER was recently appointed Dean, College of Engineering, Cornell University. He was formerly Associate Dean of Engineering, and at the same time, was Director of the School of Civil Engineering.

H. A. NELSON, who was Chief, Paint Research Division, The New Jersey Zinc Co., is now Assistant to General Manager, Technical Department for the same company.

G. B. WATERHOUSE, Professor of Metallurgy, Massachusetts Institute of Technology, has been awarded the honorary degree of Doctor of Metallurgy by the University of Sheffield, in recognition of distinguished work in iron and steel research.

ROBERT LINTON, Consulting Engineer, Los Angeles, Calif., received the honorary degree of Doctor of Science from Washington and Jefferson College on Founders' Day, October 30.

C. F. HIRSCHFELD, Chief of Research Department, The Detroit Edison Co., was awarded the Worcester Reed Warner Medal at the Fifty-eighth Annual Meeting of The American Society of Mechanical Engineers held recently in New York City. The award was made for research and contributions to the theory and practice of heat power engineering.

H. S. SMITH, Consulting Engineer, Carbide & Carbon Chemicals Corp., was awarded the Samuel Wylie Miller Medal for "meritorious contributions to the science and art of welding," by the American Welding Society. He also received the James Turner Moorehead Medal, awarded by the International Acetylene Association, "for his vision, inspirational guidance, and aggressive cooperation in the advancement of the acetylene industry."

At the recent annual meeting of the American Standards Association, F. M. FARMER, Vice-President and Chief Engineer, Electrical Testing Laboratories, was elected chairman of the Standards Council, and R. P. ANDERSON, Secretary, Division of Refining, American Petroleum Institute, was elected vice-chairman.

G. T. HORTON, President, Chicago Bridge and Iron Co., Chicago, and alumnus of Rensselaer Polytechnic Institute, Troy, N. Y., has contributed $20,000 for the establishment of a new welding laboratory at the Institute. In the past, Mr. Horton has presented the Institute with a large cabin passenger airplane for use in the aeronautical engineering course and has founded four permanent scholarships.

J. L. MINER, Technical Director, Atlas Lumnite Cement Co., New York City, has been elected director and vice-president of the company.

F. C. FRARY, Director of Research, Aluminum Company of America, has been honored with the Pittsburgh award for 1937 by the Pittsburgh section of the American Chemical Society. The award is given for distinguished research in many fields, and will be made at a meeting of the section in February.

J. L. WICK, JR., President and General Manager, The Falcon Bronze Co., has been elected a director of the industrial division, Youngstown Chamber of Commerce.

R. F. MEHL, Director and Head, Department of Metallurgy, Carnegie Institute of Technology, Pittsburgh, has been elected chairman, Institute of Metals, American Institute of Mining and Metallurgical Engineers.

RALPH BUDD, President, Chicago Burlington & Quincy Railroad, has been elected a director of the Association of American Railroads.

S. H. GRAF, Professor of Mechanical Engineering, and Director

of Engineering Research, Oregon State College, was elected president of the National Council of State Boards of Engineering Examiners at a meeting of that group in Scranton, Pa.

L. P. SAVARIE, who was Fabric Technologist, United States Testing Co., Inc., Hoboken, N. J., is now Textile Engineer, Western Electric Co., Inc., Kearny, N. J.

L. E. KERN is Associate Engineer, Inspector, Greenhills Project, F.S.A., Cincinnati, Ohio. He was formerly Specification Writer, Housing Division, Public Works Administration, Washington, D. C.

G. A. SAEGER, who was Engineer-Economist, National Research Project, W.P.A., Washington, D. C., is now Assistant Superintendent and Chief Chemist, Gulf Portland Cement Co., Houston, Texas.

E. C. R. SPOONER is connected with the Magnesium Metal Corp., Ltd., London, England. He was Technical Assistant to Works Director, The National Smelting Co., Ltd., Avonmouth, England.

EJNAR BELLING, formerly Chief Chemist, Companhia Nacional de Cimento Portland, Rio de Janeiro, Brazil, is now Chief Chemist, Cia. Argentina de Cemento Portland, Buenos Aires, Argentina.

NECROLOGY

We announce with regret the death of the following members and representatives:

GUSTAVE GIROUX, Travelling Engineer, Canadian Car and Foundry Co., Ltd., Montreal, P. G., Canada. Member since 1904.

HENRY GULICK, President Gulick-Henderson Co., Inc., New York City. Member since 1907. Mr. Gulick represented the American Transit Association on the Sectional Committee on Methods of Testing Wood.

ALAN N. LUKENS, Chief Engineer, American Locomotive Co., Railway Steel-Spring Division, New York City. Member since 1905. Mr. Lukens had been associated with his company for 50 years. He was one of the representatives of the company in its membership on Committee A-1 on Steel and Subcommittee IV on Spring Steel and Steel Springs.

W. F. MCLAREN, Engineer, Drawing Office, Canadian Westinghouse Co., Ltd., Hamilton, Ont., Canada. Member since 1923.

H. C. MYERS, Engineer of Tests, The Midvale Co., Nicetown, Philadelphia, Pa. Mr. Myers had represented his company for many years in its Society membership and on Committee A-1 on Steel and Subcommittees VI on Forgings and VII on Wheels and Tires. He had been connected with his company since 1897 and was Engineer of Tests and Inspection since 1921.

FRITZ WILLIAM SARGENT, Chief Engineer, American Brake Shoe and Foundry Co., Mahwah, N. J. Member since 1908.

BAILEY TOWNSHEND, Manager, Research Laboratories, Johns-Manville Corp., Manville, N. J. Doctor Townshend represented the company in its membership in the Society.

H. VAN DER WAERDEN, Engineer, Bataafsche Petroleum Maatschappij, 'S-Gravenhage, The Netherlands. Member since 1922.

CHARLES WARNOCK, President, Charles Warnock and Co., Ltd., Montreal, P. Q., Canada. Member since 1926.

SUMNER R. CHURCH
1879-1937

Many members of the Society will be grieved to learn of the death in New York City on December 27 of Mr. S. R. Church, Consulting Chemist. A most valued member of the Society over a period of 30 years, his membership dating from 1907, his passing will be keenly felt. The cause of death was a throat ailment from which he had suffered for a number of years.

Following his graduation from Pratt Institute in 1904 (receiving the alumni medal in chemistry) he was until 1925 connected with The Barrett Co. For several years he was Manager of the Research Department and also Manager of the Tar and Oil Division of the General Manufacturing Department. He has been in consulting practice since 1925, specializing in the field of bituminous materials.

He had been very active in the work of the Society. He became a member of Committee D-8 on Waterproofing and Roofing Materials in 1907, and was a member of Committee D-4 on Road and Paving Materials for many years. One of his most important committee activities has been as chairman of the Subcommittee on Timber Preservatives of A.S.T.M. Committee D-7 on Timber. He was chairman of this subcommittee from its organization in 1914, when he became a member of the parent committee. Mr. Church represented A.S.T.M. on the Sectional Committee on Standardization of Cast Iron Pipe and was chairman of its Subcommittee on Organic Coatings.

For many years an active member of the American Wood Preservers' Association, he was president of that organization in 1934.

In his death, the industrial fields with which he was so intimately concerned loses an outstanding leader. Many members of the Society, particularly those who worked with Mr. Church in his committee work, will lose a close friend. The Society will feel the loss of an enthusiastic member who contributed much in its behalf.

Calendar of Society Meetings

(Arranged in Chronological Order)

AMERICAN SOCIETY OF CIVIL ENGINEERS—Annual Meeting, January 19-22, New York City; Spring Meeting, April 20-22, Jacksonville, Fla.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Winter Convention, January 24-28, New York City; Summer Convention, June 20-24, Washington, D. C.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS—January 24-28, Grand Central Palace, New York City.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS—January 26-28, New York City.

ENGINEERING INSTITUTE OF CANADA—Annual Meeting, January 31-February 1, London, Ontario, Canada.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS—Annual Meeting, February 14-17, New York City.

AMERICAN CONCRETE INSTITUTE—February 22-24, Chicago, Ill.

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY—Annual Meeting, February, New York City.

American Society for Testing Materials, Spring Group Committee Meetings and Regional Meeting, March 7-11, Rochester, N. Y.; Annual Meeting, Chalfonte-Haddon Hall, June 27-July 1, Atlantic City, N. J.

AMERICAN RAILWAY ENGINEERING ASSOCIATION—March 15-17, Chicago, Ill.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Spring Meeting, March 23-25, Los Angeles, Calif.; Semi-Annual Meeting, June 20-24, St. Louis, Mo.

AMERICAN CERAMIC SOCIETY—Fortieth Annual Meeting, March 27-April 2, New Orleans, La.

AMERICAN CHEMICAL SOCIETY—Semi-Annual Meeting, April 18-21, Dallas, Texas.

AMERICAN WATER WORKS ASSOCIATION—Annual Convention, April 24-28, New Orleans, La.

AMERICAN FOUNDRYMEN'S ASSOCIATION—May 14-19, Cleveland, Ohio.

SOCIETY OF AUTOMOTIVE ENGINEERS—June 12-17, The Greenbrier, White Sulphur Springs, West Va.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Summer Convention, June 20-24, Washington, D. C.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE—Summer Meeting, June, Ottawa, Canada.

Fourth International Rail Congress

AT the conclusion of the Third International Rail Congress held in Budapest in September, 1935, it was decided to hold the next conference in 1938 in Düsseldorf, Germany. The Deutsche Reichsbahn and the Verein deutscher Eisenhüttenleute, who have agreed to make all the arrangements for the coming Congress, have suggested that it be held in the second half of September, 1938.

Since it was decided that all reports for the Congress should be printed early enough for them to be transmitted to those taking part, all manuscripts should reach the Organizing Committee not later than June 1, 1938. Those who wish to present papers are requested to inform Dr.-Ing. O. Petersen of the Organizing Committee, Ludwig-Knickmann-Strasse 27, Düsseldorf, as soon as possible.

The chief subjects to be discussed include: General questions; wear; brittleness, internal stresses, aging; operating results; structural problems; and welding.

PROFESSIONAL CARDS

Professional Cards will be accepted for inclusion on this page from Consulting Engineers, Metallurgists, Chemists, Testing Engineers and Testing Laboratories

ABBOT A. HANKS, Inc.
Engineers and Chemists
Consulting, Inspecting, Testing
Physical and Chemical Laboratories
624 Sacramento Street
SAN FRANCISCO, CALIF.

ANALYTICAL
SPECTROGRAPHIC
PHYSICAL
CORROSION
Consulting Metallurgists
LUCIUS PITKIN, Inc.
47 FULTON STREET NEW YORK
Branch: Buffalo Testing Laboratories, Inc. Gerrans Building, Buffalo, N. Y.
T E S T I N G

Metallographists *Chemists*
NEW YORK TESTING LABORATORIES
80 WASHINGTON STREET, NEW YORK CITY
Consulting and Research Engineers
Mechanical, Physical and Electrical Tests, Inspections

The J. L. Finck Laboratories
10 W. 47th St., New York. N. Y.
J. L. Finck, Ph.D., Director, Formerly with U. S. Bureau of Standards, Heat Transfer Section
Heat Insulation and Allied Fields
Consultation · Tests · Development Work
Thermal Conductivity Tests at all ranges of temperature on Insulating and Refractory Materials

The Gravelle Laboratory
Technical microscopy and photomicrographs for Research, Control and Advertising in the Paint, Paper, Textile, Chemical and Allied industries.
114 Prospect St., South Orange, N. J.

WEISS AND DOWNS, Inc.
CHEMICAL ENGINEERS
Specialists in
BITUMINOUS MATERIALS
J. M. Weiss, Member, A.S.T.M.
50 E. 41st Street, New York City

PATZIG LABORATORIES
PATZIG LABORATORIES
ENGINEERING INSPECTION
TESTS · ANALYSES · RESEARCH
CONSULTATION
2215 Ingersoll Ave. Des Moines, Iowa

A. W. WILLIAMS INSPECTION COMPANY
Specializing in the Inspection of
POLES, PILING, CROSSARMS, CROSS TIES, CONDUIT, LUMBER, STRUCTURAL TIMBER and PRESERVATIVE TREATMENTS
Analyses of Wood Preservatives
MOBILE, ALABAMA
Inspectors for Assignments at All Plants

CLAUD S. GORDON COMPANY
ENGINEERS
X-Ray, Pyrometer, and High Temperature Testing Laboratories
SERVICE
1524 S. WESTERN AVE., CHICAGO

SOUTHWESTERN LABORATORIES
Consulting, Analytical Chemists and Chemical Engineers
Inspections, Testing and Chemical Work
Fort Worth, Dallas, Houston
and
San Antonio, Texas

On this page are announcements by leading organizations and individuals of their services for testing, research, and consulting work. In the solution of many problems the guidance of professional advice is often most helpful and desirable.

LEDOUX & COMPANY, INC.
Chemists, Assayers, Engineers
Samplers and Weighers
155 SIXTH AVE.
NEW YORK, N. Y.

THE WAYNE LABORATORIES
Chemical and Bacteriological Consultants
Specialists in Research Problems
Micro and Macro Photography
17 E. Main St. Waynesboro, Pa.

Shilstone Testing Laboratory
INSPECTING AND CONSULTING
CHEMISTS & ENGINEERS
CARGO SURVEYORS
New Orleans, La. Houston, Tex.
Shreveport, La. Corpus Christi, Tex.
Inspectors at all Leading Industrial Centers

ELECTRICAL TESTING LABORATORIES
Electrical, Photometric, Mechanical, and Chemical testing and research.
NEW YORK
80TH ST. AND EAST END AVE.
ETL
Know by Test

ROBERT W. HUNT COMPANY
Inspection, Tests, Consultation, Research **ENGINEERS**
CHEMICAL, PHYSICAL, X-RAY, METALLURGICAL, CEMENT and CONCRETE LABORATORIES.
THE SEAL OF H OF QUALITY
175 W. Jackson Blvd., CHICAGO, *And All Large Cities*